

**Technical and Professional
Education**

**Curriculum Content Frameworks for
Construction Technology**

**Curriculum Content Frameworks for
Construction Technology
Developed by the
University of Arkansas at Little Rock**

**State of Arkansas
Department of Workforce Education**

NOTICE TO THE READER

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Preface

The Technical and Professional Education program continues to prepare students for employment and continuing education. To accomplish this preparation, teachers and employers have collaborated to modify individual programs to ensure that instruction is current and comprehensive. This document reflects essential competencies for program completers as well as All Aspects of the Construction Technology Industry as required by the Carl D. Perkins Act. The Curriculum Content Frameworks for all Technical and Professional Education programs can be accessed through the Department of Workforce Education Web site.

Forward

The curriculum content framework Construction Technology supports the courses that prepare students for the following career roles, which in turn correspond to the CIP (Classification of Instructional Programs) codes listed below. The Construction cluster of programs prepares students for careers in the fields of building trades, cabinetmaking, facilities management, building maintenance, climate control, and appliance repair. Careers within the Construction cluster are as follows:

- Career Family: Architecture and Construction
- Career Area: Construction Trades
- Career Role CIP Code:
 - Cabinetmaking/Cabinetmaker – 48.0703
 - Carpentry/Carpenter – 46.0201
 - Utility/Heavy Construction Technology – 46.0301
- O-NET
 - Cabinetmakers and Bench Carpenters – 51-7011.00
 - Carpenter – 47-2031.XX
 - Carpenter’s Helper – 47-3012.00
- Career Role CIP Code:
 - Electrician – 46.0302
 - HVACR Technology Technician – 47.0201
- O-NET
 - Electricians – 47-2111.XX
 - Electrician’s Helpers 47-3013.00
 - Heating, Ventilation, Air Conditioning, and Refrigeration Mechanics – 49-9021.00
- Career Role CIP Code:
 - Masonry/Mason – 46.0101
 - Concrete Finishing/Concrete Finisher – 46.0402

- O-NET
 - Cement Masons and Concrete Finishers – 47-2051.XX
 - Brick Masons and Block Masons – 47-2021.XX
- Career Role CIP Code:
 - Plumbing Technology/Plumber – 46.0503
- O-NET
 - Plumbers, Pipefitters, and Steamfitters– 47-2152.XX
- Career Role CIP Code:
 - Drywall Installers – 46.0404
- O-NET
 - Drywall Installers – 47-2081.XX

Acknowledgments

The Construction Technology curriculum content framework was produced by a team of program developers from the University of Arkansas at Little Rock and representatives from industry and education. A panel of experts in the Building Trades reviewed the framework. The format and content of the framework reflect the specific training needs within the state of Arkansas. The framework content and format is modeled after a document originally developed by a writing team under the auspices of the Virginia Department of Education. Grateful appreciation is expressed to the Virginia Department of Education for granting the Arkansas State Department of Workforce Education access to their instructional frameworks.

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Introduction

About the Program

Tasks for Construction Technology are based on standard practices within the state of Arkansas for the Masonry, Carpentry, Electricity, and Plumbing programs. A panel of practitioners representing the building trade industries in Arkansas validated these tasks.

About the Document

Contents of the document are presented in two major sections.

- Section 1 contains a master duty/task list for the Construction Technology Program. The master duty/task list is arranged in duty areas.
- Section 2 contains an analysis of each task, consisting of the task, task definition and process/skill questions to assess student progress.
- Section 3 lists the Arkansas Standards of Learning for Language Arts, Mathematics, and Science. These Arkansas SOL are reinforced by instruction in the Construction Technology program.

Program Description

494450 – Bricklaying

494460 – Carpentry

494470 – Concrete Masonry

494480 – Fundamentals of Construction

494490 – Drywall

494500 – Electrical

494510 – Plumbing

This group of instructional programs prepares students to erect, install, maintain, and repair buildings, and other structures using materials such as metal, wood, stone, brick, glass, concrete and composition substances. Students develop skills in estimating costs; cutting, fastening, and fitting various materials; using hand and power tools; and following technical specifications and construction drawings.

Master Duty/Tasks Listing
Construction Technology
Construction Fundamentals
Carpentry
Bricklaying
Concrete Masonry
Drywall
Masonry
Electrical
Plumbing

National and state experts in the occupational field of Construction Technology have validated the duties and tasks in this section. Each is analyzed by identifying the following:
a duty/task statement, which describes what the student is to do

NOTE: Construction Fundamentals Duty and Task statements are designated with an (FC) on the line below those Tasks to be included in the Construction Fundamentals course (494480).

BRICKLAYING
DUTY A:
Tools Used in the Masonry Field
Task:
A 010: Identify hand tools used for working with masonry (CF)
A 020: Identify power tools used for working with masonry (CF)
DUTY B:
Performing Entry-Level Brick Masonry
Task:
B 010: Dry Bond a brick course (CF)
B 020: Spreading mortar
B 030: Forming masonry joints
B 040 Lay a stretcher course
B 050: Use of a mason's line

B 060: Lay a running bond to a mason's line
B 070: Gauge a masonry wall with a mason's rule
B 080: Strike mortar joints
B 090: Build a rack-back brick lead
B 100: Build a straight brick lead
B 110: Build brick corners
B 120: Build rectangular brick columns
B 130: Identify types and sizes of brick
DUTY C:
Brick Positions and Bonds
Task:
C 010: Identify brick positions
C 020: Lay an American/Common bond pattern
C 030: Lay an English bond pattern
C 040: Lay a Flemish bond pattern
C 050: Lay a stack bond pattern
C 060: Lay a soldier course
C 070: Lay a rowlock course
DUTY D:
Concrete Masonry Units
Task:
D 010: Face shell bedding of masonry block units
D 020: Apply head joints on masonry block
D 030: Lay out a masonry block wall

D 040: Lay masonry block to the mason's line
D 050: Build a masonry block jamb
D 060: Build a masonry block corner
D 070: Gauge height for masonry block walls
D 080: Identify types and sizes of masonry block units
DUTY E: Identifying and Mixing Masonry Cements
Task:
E 010: Differentiate among types of masonry cements
E 020: Mixing masonry cements
E 030: Select masonry cement appropriate for a job
DUTY F: Residential Masonry
Task:
F 010: Constructing masonry block foundations
F 020: Constructing masonry block piers
F 030: Construct a brick veneer wall
F 040: Install base and counter flashings on a masonry wall
F 050: Building quoined brick corners
F 060: Building a brick window sill
F 070: Building brick arches
F 080: Forming corbel and racking on a brick wall
F 090: Building a brick stoop
F 100: Building brick steps

F 110: Install mortared brick paving
F 120: Fireplace and chimney construction
DUTY G: Constructing Commercial Masonry
Task:
G 010: Identify masonry wall systems
G 020: Building a masonry composite wall system
G 030: Building a composite masonry cavity wall system
G 040: Install rigid wall insulation
G 050: Install bearing plates
G 060: Set lintels in a brick wall
G 070: Form and build a bonded beam
G 080: Set and anchor metal frames
G 090: Grout masonry walls
G 100: Form a control or expansion joint
DUTY H: Performing Advanced Masonry Skills
Task:
H 010: Build a radial brick column
H 020: Lay a garden wall pattern
H 030: Clean brick walls
H 040: Repair masonry work
H 050: Lay glass block
H 060: Lay structural clay tile

CARPENTRY
DUTY I: Identify Tools Used in the Carpentry Field
Task:
I 010: Maintain a clean construction working environment (CF)
I 020: Identify hand tools used for working in carpentry (CF)
I 030: Identify power tools used for working in carpentry (CF)
I 040: Maintain and make minor adjustments to hand and power tools
I 050: Demonstrate use of ladders (CF)
I 060: Demonstrate use of scaffolding
DUTY J: Reference Technical Information
Task:
J 010: Use technical references to gather information (CF)
J 020: Reference local building code information
J 030: Reference electronic information sources
J 040: Discuss the role of teams in the construction trade
DUTY K: Math Skills For Construction
Task:
K 010: Utilize measuring instruments found in the construction industry (CF)
K 020: Describe the use of common and specialized units of measurement for construction materials (CF)
K 030: Measure various dimensions (CF)
K 040: Using measurement technology

K 050: Apply basic mathematics skills used in the construction industry
K 060: Perform mathematical calculations using feet and inches
K 070: Manipulate formulas common in the construction industry
K 080: Perform mathematical calculations involving practical geometry
DUTY L: Using Construction Materials
Task:
L 010: Handle/store construction materials (CF)
L 020: Identify construction materials (CF)
DUTY M: Using Basic Carpentry Skills
Task:
M 010: Check stock and/or assemblies for squareness (CF)
M 020: Measure materials (CF)
M 030: Determine if surfaces are level and plumb using a level (CF)
M 040: Fasten stock with metal fasteners (e.g., nails, screws, staples, and other mechanical fasteners) (CF)
DUTY N: Cutting And Shaping Stock
Task:
N 010: Crosscut and rip saw stock to size (CF)
N 020: Bore holes (CF)
N 030: Cut various joints (CF)
DUTY O: Interpreting Construction Drawings
Task:
O 010: Identify the 5 basic drawings in a set of construction drawings
O 020: Interpret symbols used on construction drawings (CF)

O 030: Interpret dimensions and information from a construction drawing (CF)
O 040: Perform calculations using architectural dimensions
O 050: Read/interpret scale
DUTY P: Estimating And Selecting Materials
Task:
P 010: Estimate materials from construction drawings
P 020: Estimate material and labor cost
P 030: Determine proper use of materials
DUTY Q: Preparing the Building Site
Task:
Q 010: Establish building reference points
Q 020: Square building walls
DUTY R: Framing A Floor
Task:
R 010: Check condition of foundation for floor framing
R 020: Install sill plates
R 030: Read floor-framing layout
R 040: Cut and crown floor joists
R 050: Install floor joists
R 060: Cantilevered floor joists
R 070: Install bridging and blocking
R 080: Install sub-floor sheathing

R 090: Select fasteners for floor joist construction
R 100: Describe engineered joist systems
DUTY S:
Framing A Wall
Task:
S 010: Lay out walls & stud framing detail on wall plates for floor deck (CF)
S 020: Cut wall plate components
S 030: Cut wall framing components (headers, sills, and full, jack, and cripple studs)
S 040: Assemble and install corner post and T-posts
S 050: Assemble headers for doors and windows (CF)
S 060: Frame door & window openings (CF)
S 070: Assemble wall sections (CF)
S 080: Install double top plate (cap plate)
S 090: Install wall blocking (backing)
S 100: Install fire stops
S 110: Install corner brace
S 120: Install exterior wall sheathing
S 130: Raise and anchor wall section
S 140: Plumb, align, and brace wall section
DUTY T:
Framing A Ceiling
Task:
T 010: Layout ceiling framing detail
T 020: Cut ceiling joists

T 030: Install ceiling joists
T 040: Frame ceiling opening
T 050: Install strongback (stiffener or catwalk)
DUTY U: Framing A Roof
Task:
U 010: Read roof framing details
U 020: Lay out common, cripple, jack, and header rafters
U 030: Lay out truss rafters
U 040: Reproduce common and truss rafters from a pattern (CF)
U 050: Install ridge board
U 060: Frame roof opening
U 070: Install common, cripple and jack rafters
U 080: Install truss rafters
U 090: Frame gable end overhang
U 100: Install collar beams (rafter ties)
U 110: Install purlins
U 120: Install roof sheathing
DUTY V: Installing Roofing
Task:
V 010: Install roofing underlayment
V 020: Install roof flashing
V 030: Install roofing shingles

V 040: Install ridge cap shingles
V 050: Install composite shingles in valley
V 060: Install composite shingles around roof openings
DUTY W: Construct and Install Stairs
Task:
W 010: Calculate rise and run for stairs
W 020: Lay out straight run stair stringer
W 030: Cut stair component
W 040: Construct and install stair unit
CONCRETE MASONRY
DUTY X: Identify Concrete Materials
Task:
X 010: Identify materials used to manufacture concrete
X 020: Identify properties of Portland cement
X 030: Identify properties of water used to manufacture concrete
X 040: Identify types and uses of aggregates for concrete
X 050: Identify types and uses of admixtures for concrete
DUTY Y: Using Concrete Tools
Task:
Y 010: Identify hand tools used for working with concrete
Y 020: Identify power tools used for working with concrete
DUTY Z: Performing Concrete Layout
Task:

Z 010: Identify concrete measuring and layout tools
Z 020: Layout of concrete slabs
Z 030: Using concrete forms
DUTY AA: Techniques for Placing and Finishing Concrete
Task:
AA 010: Placing concrete in forms
AA 020: Placing concrete for footings and foundations
AA 030: Finishing concrete
DRYWALL
DUTY BB: Identify Drywall Materials
Task:
BB 010: Identify characteristics of drywall materials
BB 020: Identify Fasteners for drywall materials
DUTY CC: Using Drywall Tools
Task:
CC 010: Identify tools for hanging drywall materials
CC 020: Tools and materials for finishing drywall joints
DUTY DD: Performing Drywall Layout
Task:
DD 010: Layout of drywall materials
DUTY EE: Techniques for Hanging and Finishing Drywall
Task:
EE 010: Installing Drywall Materials
EE 020: Finishing Drywall Materials

EE 030: Applying textured finishes to drywall
EE 040: Application of textured finishes on drywall ceilings
ELECTRICITY
DUTY FF: Applying Basic Electrical Theory
Task:
FF 010: Explain electron theory and the relationship to circuit design using Ohm's Law
DUTY GG: Identify Tools used in the Electrical Field
Task:
GG 010: Identify hand tools used for working with electricity
GG 020: Identify power tools used for working with electricity
DUTY HH: Safe Practices for Working with Electricity
Task:
HH 010: Identify safe practices for hand tools when working with electricity (CF)
HH 020: Identify safe practices for electric power tools when working with electricity
HH 030: Describe electrical lockout/tagout procedures
HH 040: Explain safe working practices related to electrical hazards
HH 050: Demonstrate safe housekeeping procedures for working with electricity
DUTY II: Using Tools And Materials in the Electrical Field
Task:
II 010: Demonstrate the safe use of hand tools when working with electricity (CF)
II 020: Demonstrate the safe use of power tools when working with electricity
II 030: Use Digital Volt Ohm Meters (DVOM) to take readings on electrical circuits
II 040: Maintain an electrical component inventory

DUTY JJ: Characteristics of Electrical Circuits
Task:
JJ 010: Calculate electrical loads in series circuits
JJ 020: Wire series circuits (CF)
JJ 030: Troubleshoot series circuits
JJ 040: Calculate electrical loads in parallel circuits
JJ 050: Wire parallel circuits (CF)
JJ 060: Troubleshoot parallel circuits
DUTY KK: Navigating the National Electrical Code (NEC) Book
Task:
KK 010: Explain intent of the National Electrical Code (NEC) (Article 90)
KK 020: Interpret the NEC requirements for electrical installation
DUTY LL: Installing Conduit
Task:
LL 010: Describe types and sizes of electrical conduit
LL 020: Describe types of fittings and connections used with electrical conduit
LL 030: Identify benders and the bending process used with electrical conduit
DUTY MM: Installing Electrical Conductors
Task:
MM 010: Identify various types of conductors used for electrical service
MM 020: Select and install conductors for residential electrical service
MM 030: Use lugs, connectors, and terminals to make connections for electrical service
DUTY NN: Installing Panel Boards and Switchboards

Task:
NN 010: Install an electrical service panel
NN 020: Identify the purpose and location of over current devices (OCD's)
NN 030: Select over current devices (OCD's)
NN 040: Install over current devices (OCD's)
NN 050: Install ground fault circuit-interrupter (GFCI) devices
DUTY OO: Installing Grounding Systems
Task:
OO 010: Describe characteristics of electrical grounding systems
OO 020: Demonstrate sizing, layout, and installation of grounding systems
DUTY PP: Electrical Prints and Specifications
Task:
PP 010: Develop electrical plans
PP 020: Interpret electrical plans and specifications
PLUMBING
DUTY QQ: Practicing Safety on the Plumbing Job Site
Task:
QQ 010: Describe chemical risks associated with plumbing occupations, referencing Material Safety Data Sheets
DUTY RR: Introducing the Plumbing Trade
Task:
RR 010: Discuss the historical development of the plumbing trade
RR 020: Describe the importance of plumbers in modern society
RR 030: Describe the functions of water supply systems (CF)
RR 040: Describe the functions of sewage treatment systems (CF)

DUTY SS: Math in the Plumbing Trade
Task:
SS 010: Measure various pipe dimensions (CF)
SS 020: Perform mathematical calculations related to plumbing using feet and inches as the units of measure (CF)
SS 030: Calculate area and volume related to plumbing
SS 040: Calculate fitting allowance
Duty TT: Interpret Plumbing Construction Drawings
Task:
TT 010: Identify plumbing fixtures depicted on plumbing construction drawings
TT 020: Develop fitting/material lists based on plumbing construction drawings
DUTY UU: Identify Tools Used in the Plumbing Industry
Task:
UU 010: Identify hand tools used for working in the plumbing industry (CF)
UU 020: Identify power tools used for working with plumbing
DUTY VV: Cutting and Joining Pipe
Task:
VV 010: Cut cast iron pipe
VV 020: Cut and deburr copper tubing
VV 030: Cut plastic pipe with PVC/ABS saw or approved cutter (CF)
VV 040: Cut & ream steel pipe
VV 050: Join cast iron pipe using rubber-type seal and no-hub connectors
VV 060: Construct copper pipe (tubing) assembly using solder joints
VV 070: Join plastic pipe (tubing) to fittings using solvent method (CF)

VV 080: Join copper pipe (tubing) using compression fittings
VV 090: Join copper pipe (tubing) to fittings using flare method
VV 100: Join plastic pipe (tubing) to fittings using crimp ring method
VV 110: Join plastic pipe (tubing) to fittings using clamp/insert fittings method
VV 120: Join pipe with flexible sleeve couplings
VV 130: Thread steel pipe with power-driven thread cutter
VV 140: Thread steel pipe using hand thread cutter and oilers
VV 150: Join pipe of dissimilar materials
DUTY WW: Supporting and Hanging Pipe
Task:
WW 010: Identify types of anchors and straps for commercial plumbing applications.
WW 020: Install backing and ledger supports for plumbing fixtures
WW 030: Install pressure piping, using various supports, including wire pipe hooks, tube talon, or tube straps
WW 040: Install DWV (drainage, waste, and vent) pipe, using various types of supports (e.g., perforated strap, pipe hooks, and riser clamps)
WW 050: Describe the correct installation of pipe sleeves through a concrete or masonry wall
DUTY XX: Install Waste and Soil Pipes
Task:
XX 010: Rough-in a DWV (drainage, waste, and vent) pipe assembly of PVC/ABS piping
XX 020: Calculate and set waste and soil pipes
XX 030: Install a water closet flange
XX 040: Describe the use of a backflow valve

XX 050: Perform a drainage system standing water/air leak test
DUTY YY:
Components of a Water Distribution System
Task:
YY 010: Identify procedures and materials for installing a building's water service
YY 020: Install a water distribution system
YY 030: Perform air-pressure & water-pressure tests
YY 040: Insulate water supply lines
YY 050: Install nail guard protection for piping
DUTY ZZ:
Installing Plumbing Fixtures and Equipment
Task:
ZZ 010: Install and trim out a lavatory
ZZ 020: Install and trim out a kitchen sink
ZZ 030: Install and trim out a water closet
ZZ 040: Install a garbage disposer
ZZ 050: Install an automatic dishwasher
ZZ 060: Install a water heater
ZZ 070: Trim out a tub and shower valve
ZZ 080: Install an outside water faucet
DUTY AAA:
Service and Repair Plumbing Fixtures and Equipment
Task:
AAA 010: Replace and adjust water control mechanisms for a water closet
AAA 020: Replace a water closet flush valve

AAA 030: Troubleshoot and repair or replace automatic flushing devices
AAA 040: Operate a plumbing drain auger
AAA 050: Remove and Replace a fixture trap
AAA 060: Repair or replace a washer-type faucet
AAA 070: Repair/replace washerless faucets
AAA 080: Repair or replace shower diverter valve
AAA 090: Replace a bathtub waste and overflow pipe
AAA 100: Replace a bathtub shower arm and shower head
AAA 110: Troubleshoot and replace garbage disposer
AAA 120: Troubleshoot and repair/replace a gas or electric water heater
AAA 130: Thawing frozen water pipes
AAA 140: Install plumbing repair coupling

Construction Technology
Task Definition Statements
Construction Fundamentals 494480
Carpentry 494460
Concrete Masonry 494470
Drywall 494490
Electrical 494500
Bricklaying 494450
Plumbing 494510

National and state experts in the occupational field of Construction Technology have validated tasks in this section. Each task is analyzed by identifying the following:

- a *task definition* (criteria for acceptable performance), which explains what the student has to do to perform the task at the expected level of mastery
- *process/skill questions*, which assess student knowledge and performance.

Tasks are arranged by instructional duty area only. The placement of tasks into specific courses and the sequencing of tasks for instruction are local decisions based on student needs, employer demand, and school schedules.

NOTE: Construction Fundamentals Duty and Task statements are designated with an (FC) on the line below those Tasks to be included in the Construction Fundamentals course (494480).

BRICKLAYING
DUTY A: Tools Used in the Masonry Field
Task:
A 010: Identify hand tools used for working with masonry (CF) <i>Definition:</i> Process should include the following: <ul style="list-style-type: none"> • identify uses for common hand tools used in the masonry field • identify uses for specialized hand tools used for working with masonry • select proper hand tools for specific tasks related to working with masonry Process/Skill Questions

A 020: Identify power tools used for working with masonry (CF)

Definition: Process should include the following:

- identify uses for common power tools used in the masonry field
- identify uses for specialized power tools used for working with masonry
- select proper power tools for specific tasks related to working with masonry

Process/Skill Questions

**DUTY B:
Performing Entry-Level Brick Masonry**

Task:

B 010: Dry Bond a brick course (CF)

Definition: Process should include the following:

- demonstrate techniques for maintaining joint spacing for a dry bond
- dry bond a course of brick with 3/8" joints
- adjust a dry bond brick course

Process/Skill Questions

B 020: Spreading mortar

Definition: Process should include the following:

- demonstrate techniques for cutting mortar from a mortar board
- demonstrate techniques for loading a trowel with mortar
- demonstrate techniques for spreading and furrowing mortar on a wall joint

Process/Skill Questions

B 030: Forming masonry joints

Definition: Process should include the following:

- demonstrate techniques to apply mortar to end of a brick to form 3/8" full head joint
- demonstrate techniques to apply mortar to bed joints to form 3/8" bed joint
- identify methods to maintain uniform bed joint thickness and full coverage of mortar

Process/Skill Questions

B 040 Lay a stretcher course

Definition: Process should include the following:

- lay whole brick end to end in a stretcher course

Process/Skill Questions

B 050: Use of a mason's line

Definition: Process should include the following:

- fasten mason's line blocks to a corner
- attach mason's line twigs (trig) along a course
- attach mason's line pins to a wall
- demonstrate methods to maintain mason's lines, tight, secure, and level with brick course

Process/Skill Questions

B 060: Lay a running bond to a mason's line

Definition: Process should include the following:

- lay brick in 1/2 lap running bond
- lay brick level with the mason's line
- maintain consistent mason's line clearance
- maintain mason's line flush with top of course below

Process/Skill Questions

B 070: Gauge a masonry wall with a mason's rule

Definition: Process should include the following:

- demonstrate use of the mason's rule to lay out the courses of a masonry wall
- lay out brick walls level with tops of openings
- describe and set proper spacing for seals or wire reinforcements

Process/Skill Questions

B 080: Strike mortar joints

Definition: Process should include the following:

- identify tools used to finish mortar joints in masonry walls
- demonstrate techniques to compact and finish mortar joints
- describe characteristics of concave, rake, "V" shaped, grapevine, weathered, and troweled mortar joints

Process/Skill Questions and tools

B 090: Build a rack-back brick lead

Definition: Process should include the following:

- describe the construction of a rack-back brick lead.
- lay a first course of running bond, maintaining uniform joint width
- lay succeeding course, rack back 1/2 brick on each end using one less brick

Process/Skill Questions

B 100: Build a straight brick lead

Definition: Process should include the following:

- describe the construction of a straight brick lead
- lay brick on a stretcher bond for a straight lead
- form a plumb jamb
- rack back 1/2 brick on opposite end while maintaining uniform joint width

Process/Skill Questions

B 110: Build brick corners

Definition: Process should include the following:

- describe techniques for lay out of 90° brick corners
- lay out a brick corner in 90° orientation, maintaining plumb and level
- maintain uniform joint width on brick corners

Process/Skill Questions

B 120: Build rectangular brick columns

Definition: Process should include the following:

- describe techniques for layout of a brick column
- lay brick columns with 90° corners, maintaining level and plumb, with uniform joint width
- describe methods to maintain brick level and plumb for brick columns

Process/Skill Questions

B 130: Identify types and sizes of brick

Definition: Process should include the following:

- identify sizes used for standard, modular standard, engineered, economy, utility, and special sizes and shapes of brick
- describe characteristics for types of common brick, face brick, and severe weather brick
- distinguish between grades of residential and commercial brick

Process/Skill Questions

**DUTY C:
Brick Positions and Bonds**

Task:

C 010: Identify brick positions

Definition: Process should include the following:

- identify a stretcher, header, rowlock, soldier, sailor, and shiner course on a wall
- describe techniques for laying stretcher, header, rowlock, soldier, sailor, and shiner courses on a wall

Process/Skill Questions

C 020: Lay an American/Common bond pattern

Definition: Process should include the following:

- identify characteristics of an American/Common bond pattern
- set a panel of stretchers with header course every fifth, sixth, or seventh course
- maintain headers centered either on the brick or head joint below

Process/Skill Questions

C 030: Lay an English bond pattern

Definition: Process should include the following:

- identify characteristics of an English bond pattern
- set a panel of alternating courses of stretchers and headers in an English bond pattern

Process/Skill Questions

C 040: Lay a Flemish bond pattern

Definition: Process should include the following:

- identify characteristics of a Flemish bond pattern
- set alternating headers and stretchers forming a Flemish bond pattern

Process/Skill Questions

C 050: Lay a stack bond pattern

Definition: Process should include the following:

- identify characteristics of a stack bond pattern
- set panel of stretcher course with each brick laid directly above the one below
- maintain head joints vertically aligned in a stack bond pattern

Process/Skill Questions

C 060: Lay a soldier course

Definition: Process should include the following:

- identify characteristics of a soldier course
- set stretchers on end with the face showing on the wall surface of a soldier course

Process/Skill Questions

C 070: Lay a rowlock course

Definition: Process should include the following:

- identify characteristics of a rowlock course
- lay brick course on its side with the face of the brick facing the top

Process/Skill Questions

**DUTY D:
Concrete Masonry Units****Task:****D 010: Face shell bedding of masonry block units**

Definition: Process should include the following:

- identify characteristics of face shell bedding
- describe techniques for spreading mortar on masonry block units
- demonstrate the spreading of mortar on both sides of a masonry block
- describe techniques to maintain course height and uniform joint thickness to support another unit

Process/Skill Questions

D 020: Apply head joints on masonry block

Definition: Process should include the following:

- describe techniques for spreading mortar on ends of masonry block units
- demonstrate spreading mortar on both sides of one end of masonry block units
- maintain a uniform 3/8" head joint
- describe techniques to maintain uniform joint width with masonry block units

Process/Skill Questions

D 030: Lay out a masonry block wall

Definition: Process should include the following:

- describe techniques to space masonry block units for a wall
- establish proper spacing of masonry block units using a measuring tape or ruler to bond a wall on 16" intervals

Process/Skill Questions

D 040: Lay masonry block to the mason's line

Definition: Process should include the following:

- describe techniques to consistently lay masonry blocks to a mason's line
- lay masonry block in 1/2 lap
- lay block level with the line maintaining consistent line clearance

Process/Skill Questions

D 050: Build a masonry block jamb

Definition: Process should include the following:

- describe techniques for forming a plumb jamb
- lay course of masonry block in running bond
- form a plumb jamb while maintaining 3/8" uniform joint thickness

Process/Skill Questions

D 060: Build a masonry block corner

Definition: Process should include the following:

- describe techniques to lay out masonry block corners in 90° orientation
- lay out masonry block corners in 90° orientation, maintaining masonry block plumb, level, and joint thickness
- lay step block back 8 inches on each tail

Process/Skill Questions

D 070: Gauge height for masonry block walls

Definition: Process should include the following:

- describe techniques for maintaining uniform height for masonry block wall courses
- lay block wall with 8" intervals in height

Process/Skill Questions

D 080: Identify types and sizes of masonry block units

Definition: Process should include the following:

- identify nominal sizes for masonry block units
- define special sizes and shapes of masonry block units
- define types of masonry block units (light weight/cement)

Process/Skill Questions

**DUTY E:
Identifying and Mixing Masonry Cements****Task:****E 010: Differentiate among types of masonry cements**

Definition: Process should include the following:

- identify applications, strengths, and proper use of the three most commonly used cements (M, S, and N)
- describe additives used in masonry cements, (e.g., accelerators, retardants, water repellant agents, colors, air-entraining agents)

Process/Skill Questions

E 020: Mixing masonry cements

Definition: Process should include the following:

- describe methods used to mix masonry cements on the job site
- demonstrate the blending and mixing of masonry cement ingredients in proper proportion using a mortar and hoe
- blend and mix masonry cement ingredients in proper proportion according to industry standards using a power mixer

Process/Skill Questions

E 030: Select masonry cement appropriate for a job

Definition: Process should include the following:

- determine tensile and compressive strength of masonry cement needed for a particular application according to specifications of an architect, engineer, or local codes
- blend and mix masonry cement according to specifications needed for a particular application

Process/Skill Questions

**DUTY F:
Constructing Residential Masonry****Task:**

F 010: Constructing masonry block foundations

Definition: Process should include the following:

- describe the construction of perimeter walls of a masonry foundation
- describe the necessity and installation of anchor bolts to a masonry foundation
- describe techniques for constructing vents, piers, and parging for a masonry foundation
- describe techniques used to check a masonry foundation for square, plumb and level, and of specified height
- identify characteristics that determine a masonry foundation meets local codes

Process/Skill Questions

F 020: Constructing masonry block piers

Definition: Process should include the following:

- describe the construction of masonry block piers to support structural framing
- describe local codes related to construction of masonry block piers

Process/Skill Questions

F 030: Construct a brick veneer wall

Definition: Process should include the following:

- describe the construction characteristics of a brick veneer wall
- construct a brick veneer wall that is plumb, level, and properly scaled
- describe the necessity for installation of flashing, weep holes, sills, wall ties, and arches for a brick veneer wall
- install masonry veneer ties in compliance with local codes
- determine that a brick veneer wall meets local codes

Process/Skill Questions

F 040: Install base and counter flashings on a masonry wall

Definition: Process should include the following:

- describe the purpose for base and counter flashing in a masonry wall
- describe technique for installing base and counter flashing above grade level, at sills
- describe technique for installing flashing across openings to allow moisture to escape cavity
- demonstrate techniques for forming weep holes or wicking to allow water drainage to the surface of a wall

Process/Skill Questions

F 050: Building quoined brick corners

Definition: Process should include the following:

- describe characteristics of a quoined brick corner
- build a quoined brick corner that is level and plumb
- maintain uniform racking and corbeling according to plans for a quoined corner

Process/Skill Questions

F 060: Building a brick window sill

Definition: Process should include the following:

- describe techniques for building a window sill with masonry in a rowlock position
- describe techniques for maintaining proper slope and spacing in a masonry window sill
- describe techniques for installing flashing on a masonry window sill
- demonstrate techniques for building window sill with masonry brick

Process/Skill Questions

F 070: Building brick arches

Definition: Process should include the following:

- describe methods to lay out, form, and build masonry arches
- describe characteristics of jack, segmental, and semicircular arches
- describe techniques to maintain uniform joints in arch construction
- describe techniques to maintain bottom edge of brick tangent to arch form
- demonstrate techniques for building brick arches

Process/Skill Questions

F 080: Forming corbel and racking on a brick wall

Definition: Process should include the following:

- describe racking techniques to form corbeling on a brick wall
- form brick corbel and racking, with course of brick projecting from face of wall
- determine brick corbel and racking according to construction plans

Process/Skill Questions

F 090: Building a brick stoop

Definition: Process should include the following:

- describe techniques for layout of a perimeter wall for a stoop
- describe methods to determine a perimeter wall is level, plumb, and tied into foundation
- demonstrate lay out of perimeter walls for a stoop
- determine that a stoop meets local building codes

Process/Skill Questions

F 100: Building brick steps

Definition: Process should include the following:

- describe techniques for lay out and construction of brick steps
- build brick steps maintaining uniform tread and riser dimensions
- determine that a flight of steps meets local codes

Process/Skill Questions

F 110: Install mortared brick paving

Definition: Process should include the following:

- describe methods to construct mortared brick paving
- describe techniques to maintain uniform joints and flat surface for mortared paving
- install mortared brick paving on concrete surface according to design plans

Process/Skill Questions

F 120: Fireplace and chimney construction

Definition: Process should include the following:

- describe elements of fireplace and chimney construction
- discuss requirements for construction of a masonry fireplace
- consult local building codes regarding fireplace construction

Process/Skill Questions

DUTY G:**Constructing Commercial Masonry**

Task:.

G 010: Identify masonry wall systems

Definition: Process should include the following:

- label and list procedures for building a composite wall system
- label and list procedures for building a cavity wall system
- label and list procedures for building an RBM wall system
- describe procedures for grouting and/or insulation when using a wall system

Process/Skill Questions

G 020: Building a masonry composite wall system

Definition: Process should include the following:

- describe techniques for layout and construction of a masonry composite wall system
- lay out and construct a 12" composite wall using 8" block, a single brick wythe, and wire reinforcement according to specifications and local building codes

Process/Skill Questions

G 030: Building a composite masonry cavity wall system

Definition: Process should include the following:

- describe techniques for layout and construction of a masonry composite cavity wall system
- describe methods to maintain a cavity clear of mortar in a composite cavity wall system
- describe techniques for placement of rigid insulation, flashing, and wire reinforcements in a composite wall cavity
- describe local building codes for constructing a composite cavity wall
- build a composite cavity wall with 8" masonry block, minimum 2" cavity, and a single wythe of brick

Process/Skill Questions

G 040: Install rigid wall insulation

Definition: Process should include the following:

- describe techniques for placement of rigid insulation, in a composite wall cavity
- measure, cut, and install rigid insulation in a wall to fill the cavity according to specifications

Process/Skill Questions

G 050: Install bearing plates

Definition: Process should include the following:

- discuss reasons for steel bearing plates in masonry walls
- describe techniques for installing bearing plates in masonry walls
- install a steel bearing plate at specified height and anchored with mortar or grout according to specifications

Process/Skill Questions

G 060: Set lintels in a brick wall

Definition: Process should include the following:

- discuss the reasons for constructing lintels in masonry walls
- describe types of lintels used in constructing masonry walls
- describe methods used for constructing lintels in masonry walls
- install a lintel meeting engineered specifications and building codes above a window, door, or masonry opening to support the wall above

Process/Skill Questions

G 070: Form and build a bonded beam

Definition: Process should include the following:

- describe characteristics of a bond beam
- describe techniques for constructing a bond beam for a masonry wall
- form a bonded beam from concrete masonry units
- reinforce a bonded beam with steel and concrete according to engineered specifications and building codes

Process/Skill Questions

G 080: Set and anchor metal frames

Definition: Process should include the following:

- describe types of metal frames used in masonry wall construction
- describe methods of installing metal frames in masonry walls
- assemble, set, brace, plumb, and anchor a flush or wraparound frame in a masonry wall according to specifications

Process/Skill Questions

G 090: Grout masonry walls

Definition: Process should include the following:

- describe techniques for filling a masonry wall cavity with grout
- mix grout to specified slump consistency
- fill and settle grout in a wall cavity
- demonstrate high-lift and low-lift grouting methods

Process/Skill Questions

G 100: Form a control or expansion joint

Definition: Process should include the following:

- describe reasons for expansion joints in masonry walls
- describe methods of providing expansion joints in masonry walls
- form a control or expansion joint in a masonry wall according to plans
- describe techniques to maintain uniform plumb and expansion joint size

Process/Skill Questions

DUTY H:**Performing Advanced Masonry Skills****Task:****H 010: Build a radial brick column**

Definition: Process should include the following:

- describe methods of constructing a radial brick column
- describe techniques for lay out of a radial brick column
- lay out and build a radial brick column using a template and plumbing every 90° to keep each course level for a radial brick column
- use snap headers or radial brick to build a radial brick column

Process/Skill Questions

H 020: Lay a garden wall pattern

Definition: Process should include the following:

- describe the characteristics of a garden wall pattern
- describe techniques for constructing a brick wall with a garden wall pattern
- lay a garden wall pattern according to plans
- demonstrate layout for garden wall patterns for diamond, basket weave, herring-bone, and screen wall patterns

Process/Skill Questions

H 030: Clean brick walls

Definition: Process should include the following:

- describe reasons for cleaning masonry walls
- describe techniques for removing excess mortar from the face of a masonry wall
- use a chemical cleaning solution as specified by the brick and chemical manufacturer

Process/Skill Questions

H 040: Repair masonry work

Definition: Process should include the following:

- describe conditions that require repair of a masonry wall
- describe techniques for removing and cleaning damaged masonry work and mortar joints
- restore masonry and/or brick to original quality

Process/Skill Questions

H 050: Lay glass block

Definition: Process should include the following:

- describe techniques for lay out and building a glass block panel
- describe techniques to lay a glass block wall level and plumb with uniform masonry joints
- layout and build a glass block panel according to plans using masonry cement
- describe methods to clean glass block wall according to industry standards
- clean glass block wall using industry standard methods

Process/Skill Questions

H 060: Lay structural clay tile

Definition: Process should include the following:

- describe methods to lay out structural clay tile
- describe the use of masonry cement for structural clay tile
- describe methods to insure level and plumb for structural clay tile
- describe methods to create uniform joints for structural clay tile
- describe methods to clean structural clay tile according to industry standards
- lay out structural clay tile patterns according to construction plans

Process/Skill Questions

CARPENTRY**DUTY I:****Identify Tools Used in the Carpentry Field**

Task:
<p>I 010: Maintain a clean construction working environment (CF)</p> <p><i>Definition:</i> Process should include the following:</p> <ul style="list-style-type: none"> • handle and store tools, materials, and other items in an organized manner • maintain tools, materials, and other items for an orderly work space • leave work area in a clean and safe condition • list guidelines for appropriate equipment work zone safety margins • list accidents that result from failure to use appropriate guards <p>Process/Skill Questions:</p>
<p>I 020: Identify hand tools used for working in carpentry (CF)</p> <p><i>Definition:</i> Process should include the following:</p> <ul style="list-style-type: none"> • identify the purpose for common hand tools used in carpentry • identify the purpose for specialized hand tools used in carpentry • select proper hand tools for specific tasks in carpentry <p>Process/Skill Questions</p>
<p>I 030: Identify power tools used for working in carpentry (CF)</p> <p><i>Definition:</i> Process should include the following:</p> <ul style="list-style-type: none"> • identify the purpose for common power tools used in carpentry • identify the purpose for specialized power tools used in carpentry • select proper power tools for specific tasks in carpentry <p>Process/Skill Questions</p>
<p>I 040: Maintain and make minor adjustments to hand and power tools</p> <p><i>Definition:</i> Process should include the following:</p> <ul style="list-style-type: none"> • inspect hand and power tools to ensure proper working condition • comply with tool checkout procedures • demonstrate proper storage and cleaning of hand and power tools used in the construction field • identify maintenance associated with hand tools used in the construction field • identify maintenance associated with power tools used in the construction field • perform adjustments on various hand tools used in construction in accordance with industry guidelines • perform adjustments on various power tools used in construction in accordance with industry guidelines <p>Process/Skill Questions</p>

I 050: Demonstrate use of ladders**(CF)***Definition:* Process should include the following:

- identify common types of ladders used in the construction industry
- describe appropriate uses for various types of ladders
- demonstrate safe setup of single, step, and extension ladders
- inspect the setup of a ladder for compliance with standards and guidelines

Process/Skill Questions

I 060: Demonstrate use of scaffolding*Definition:* Process should include the following:

- identify common types of scaffolding used in the construction industry
- describe appropriate uses for various types of scaffolding
- explain safety considerations for setup of various types of scaffolding (e.g., manufactured, site-built), in accordance with guidelines
- inspect the setup of a scaffold for compliance with industry guidelines
- demonstrate the setup of single and multi-level scaffolding in accordance with industry guidelines

Process/Skill Questions

DUTY J:**Reference Technical Information****Task:****J 010: Use technical references to gather information****(CF)***Definition:* Process should include the following:

- demonstrate a knowledge of manufacturer's specifications and guidelines
- reference manufacturer's directions for tool or equipment use
- reference textbooks, magazines, or trade journals for construction information

Process/Skill Questions

J 020: Reference local building code information*Definition:* Process should include the following:

- reference local ordinances and building standards
- reference International Code Council (ICC) Building Codes
- reference NEC (National Electrical Code) codes

Process/Skill Questions

J 030: Reference electronic information sources

Definition: Process should include the following:

- utilize Internet sites for material or equipment information
- utilize software packages or charts for estimating materials
- access software help information sources

Process/Skill Questions

J 040: Discuss the role of teams in the construction trade

Definition: Process will include the following:

- discuss the concept of Total Quality Management (TQM), focusing on materials provided
- produce an organizational flow chart that demonstrates the role of construction workers from various trades typically found on a residential construction site

Process/Skill Questions

**DUTY K:
Math Skills For Construction****Task:****K 010: Utilize measuring instruments found in the construction industry (CF)**

Definition: Process should include the following:

- identify instruments and tools commonly used for measurement by the construction industry and describe their use
- identify specialized measuring instruments and describe how they are used in the construction industry

Process/Skill Questions

K 020: Describe the use of common and specialized units of measurement for construction materials (CF)

Definition: Process should include the following:

- describe common units of measure used for materials in the construction industry
- describe specialized units of measure for various materials
- convert measurements for length, area, volume, etc. into different units of measurement
- calculate material quantities using common and specialized units of measurement

Process/Skill Questions

K 030: Measure various dimensions**(CF)**

Definition: Process should include the following:

- demonstrate ability to read a flexible steel rule accurately to within $\pm 1/32$ "
- demonstrate ability to read a framing square accurately to within $\pm 1/32$ "
- describe uses for various measurement devices in the construction industry
- demonstrate the accurate measurement of dimension lumber
- demonstrate the accurate measurement of sheet building materials

Process/Skill Questions

K 040: Using measurement technology

Definition: Process should include the following:

- describe the use of electronic wiring locator devices
- describe the use of electronic stud finding instruments
- use an electronic calculator to perform mathematical calculations
- demonstrate the use of measurement technology
- describe the use of hand-held laser measuring devices

Process/Skill Questions

K 050: Apply basic mathematics skills used in the construction industry**(CF)**

Definition: Process should include the following:

- add, subtract, multiply, and divide mathematical problems related to construction involving whole numbers, fractions, mixed numbers, and decimals
- convert common fractions to decimals and decimals to common fractions

Process/Skill Questions

K 060: Perform mathematical calculations using feet and inches

Definition: Process should include the following:

- calculate addition, subtraction, and conversion problems related to construction accurately in accordance with industry guidelines
- perform in-your-head simple mathematical calculations used in the construction industry
- perform conversions of feet to inches and inches to feet

Process/Skill Questions

K 070: Manipulate formulas common in the construction industry

Definition: Process should include the following:

- use the associative, communicative, and distributive properties
- understand the order of operations in mathematical calculations
- demonstrate basic algebraic skills used in the construction industry
- use formulas to calculate board feet, square feet, cubic feet, square yards, and cubic yards

Process/Skill Questions

K 080: Perform mathematical calculations involving practical geometry

Definitions: Process should include the following:

- explain the use of the 3-4-5 triangle to layout a square corner
- apply the Pythagorean Theorem
- apply formulas for areas and volume
- perform mathematical calculations related to geometry used in the construction industry

Process/Skill Questions

DUTY L:**Using Construction Materials****Task:****L 010: Handle and store construction materials**

Definition: Process should include the following:

- demonstrate procedures for safe storage of various construction materials
- discuss procedures for safe storage of construction materials
- discuss environmental considerations (humidity, light and physical restrictions) for lifting, carrying, and stacking various construction materials

Process/Skill Questions

**L 020: Identify construction materials
(CF)**

Definition: Process should include the following:

- identify materials relevant to a specific construction job, including plywood, lumber, fasteners, adhesives, and millwork
- identify uses for various construction materials

Process/Skill Questions

DUTY M: Using Basic Carpentry Skills
Task:
<p>M 010: Check stock and/or assemblies for squareness (CF) <i>Definition:</i> Process should include the following:</p> <ul style="list-style-type: none"> • apply acceptable standards for squareness in various applications • explain the necessity for squareness in construction materials • explain the necessity for squareness in construction procedures <p>Process/Skill Questions</p>
<p>M 020: Measure materials (CF) <i>Definition:</i> Process should include the following:</p> <ul style="list-style-type: none"> • measure and mark stock materials within a limit of +/-1/16" • use measuring and layout tools found in the construction industry <p>Process/Skill Questions</p>
<p>M 030: Determine if surfaces are level and plumb using a level (CF) <i>Definition:</i> Process should include the following:</p> <ul style="list-style-type: none"> • check horizontal surfaces for level according to industry standards • check vertical surfaces for plumb according to industry standards <p>Process/Skill Questions</p>
<p>M 040: Fasten stock with metal fasteners (e.g., nails, screws, staples, and other mechanical fasteners) (CF) <i>Definition:</i> Process should include the following:</p> <ul style="list-style-type: none"> • select appropriate fasteners for various material and framing situations • apply appropriate fasteners for various material situations with hand or power tools <p>Process/Skill Questions</p>
DUTY N: Cutting And Shaping Stock
Task:
<p>N 010: Crosscut and rip saw stock to size (CF) <i>Definition:</i> Process should include the following:</p> <ul style="list-style-type: none"> • cut stock materials to within +/- 1/16" of specifications • cut material edges to an angle of 90° <p>Process/Skill Questions</p>

N 020: Bore holes**(CF)***Definition:* Process should include the following:

- layout hole locations accurate to within +/- 1/32" for various material situations
- bore holes accurate to within +/- 1/32" diameter

Process/Skill Questions

N 030: Cut various joints**(CF)***Definition:* Process should include the following:

- cut material to proper dimensions maintaining 90° angle on edges and cuts accurate to within +/- 1/32"
- perform miter cuts in accordance with industry guidelines
- ensure proper cut, squareness, and fit of joints

Process/Skill Questions

DUTY O:**Interpreting Construction Drawings****Task:****O 010: Identify the 5 basic drawings in a set of construction drawings***Definition:* Process should include the following:

- identify plan, elevation, section, electrical, and detail drawings in a set of construction drawings
- describe different types of information found on plan, electrical, elevation, section, and detail drawings
- identify symbols and notes used on plan, electrical, elevation, section, and detail drawings

Process/Skill Questions

O 020: Interpret symbols used on construction drawings**(CF)***Definition:* Process should include the following:

- identify symbols commonly used on construction drawings
- identify symbols use to describe building components on construction drawings
- describe types of notes found on construction drawings
- identify information found on selected views or sections of a construction drawing

Process/Skill Questions

O 030: Interpret dimensions and information from a construction drawing (CF)

Definition: Process should include the following:

- review typical architectural dimensions found on construction drawings
- retrieve dimensions from a construction drawings
- determine size information from various locations on a set of construction drawings
- determine location dimensions from a set of construction drawings
- reference project specifications for equipment and fixture requirements

Process/Skill Questions

O 040: Perform calculations using architectural dimensions

Definition: Process should include the following:

- calculate heated and cooled living space for a floor plan
- calculate total area under roof of a floor plan
- calculate locations for various features from a floor plan
- calculate quantities for various components of a plan
- calculate distances based on construction drawings

Process/Skill Questions

O 050: Read/interpret scale

Definition: Process should include the following:

- interpret reading of scales found on construction drawings, including 1/8"=1'0", 1/4"=1'0", 3/4"=1'0", etc.)
- perform measure-to-scale and scale-to-measurement conversions
- identify types of scales used for various construction drawings and details
- interpret scale measurements from a set of construction drawings

Process/Skill Questions

DUTY P:

Estimating And Selecting Materials

Task:.

P 010: Estimate materials from construction drawings

Definition: Process should include the following:

- develop a cutting list from plans indicating the size (to within +/- 1/16"), number of pieces, thickness, width, and length
- calculate number of framing members required for wall framing

Process/Skill Questions

P 020: Estimate material and labor cost

Definition: Process should include the following:

- calculate flat labor rate required for construction workers
- calculate labor profit (use current % for the industry)
- calculate material cost based on current material prices (use current % for the industry)

Process/Skill Questions

P 030: Determine proper use of materials

Definition: Process should include the following:

- determine appropriate material for a given project
- identify common material defects and limitations
- describe new and innovative construction materials and procedures

Process/Skill Questions

**DUTY Q:
Preparing the Building Site****Task:****Q 010: Establish building reference points**

Definition: Process should include the following:

- describe techniques to transfer benchmarks to building points
- transfer a line from a predetermined benchmark to a wall, checking accuracy with leveling devices

Process/Skill Questions

Q 020: Square building walls

Definition: Process should include the following:

- perform the rough layout of a building on a construction site
- describe methods to erect and square batter boards used for building construction
- erect and square batter boards used for building construction
- describe methods used to layout and square walls of a building
- lay out and square walls, using transit level or 3-4-5 method
- discuss modern laser technology used for building and foundation layout

Process/Skill Questions

**DUTY R:
Framing A Floor****Task:**

R 010: Check condition of foundation for floor framing

Definition: Process should include the following:

- verify location of anchor bolts, openings, etc. on a foundation
- evaluate a foundation for size, square, elevation and condition of concrete or block

Process/Skill Questions

R 020: Install sill plates

Definition: Process should include the following:

- install sill plates level and secured to foundation wall
- demonstrate anchor methods (anchor bolts, nails, straps) for sill plates according to building code

Process/Skill Questions

R 030: Read floor-framing layout

Definition: Process should include the following:

- determine wall and floor openings from construction drawings
- describe layout procedures for floor joist and floor openings

Process/Skill Questions

R 040: Cut and crown floor joists

Definition: Process should include the following:

- calculate and cut floor and header joists to correct length within +/- 1/16"
- demonstrate technique to form a 90° corner for floor/header joist
- describe techniques to identify, mark, and install a joist having a crown

Process/Skill Questions

R 050: Install floor joists

Definition: Process should include the following:

- install floor joists according to construction drawings and specifications
- describe nailing patterns and techniques used to install floor joist
- use specialized fasteners available for floor joist construction

Process/Skill Questions

R 060: Cantilevered floor joists

Definition: Process should include the following:

- describe methods of installing cantilevered floor joists
- describe fastening techniques used to install cantilevered floor joist

Process/Skill Questions

R 070: Install bridging and blocking

Definition: Process should include the following:

- describe nailing techniques and patterns used to install bridging and blocking
- describe installation techniques for situations on floor joists requiring blocking
- install bridging and blocking according to plans and specifications

Process/Skill Questions

R 080: Install sub-floor sheathing

Definition: Process should include the following:

- describe consideration for sub-floor sheathing regarding expansion and staggered joints
- describe layout patterns used when installing sub-floor sheathing
- describe nailing techniques and patterns used to install sub-floor sheathing
- install sub-floor sheathing according to manufacturer's instructions

Process/Skill Questions

R 090: Select fasteners for floor joist construction

Definition: Process should include the following:

- identify fasteners needed for framing a floor system
- describe specialized fasteners available for floor joist construction
- describe advantages and disadvantages of specialized fasteners for joist construction
- demonstrate the use of specialized fasteners for framing a floor system

Process/Skill Questions

R 100: Describe engineered joist systems

Definition: Process should include the following:

- describe characteristics of engineered joist systems (I-joists, trusses, etc.)
- describe installation of engineered joist systems
- describe advantages and disadvantages of engineered joist systems

Process/Skill Questions

DUTY S:
Framing A Wall

Task:
<p>S 010: Lay out walls & stud framing detail on wall plates for floor deck (CF)</p> <p><i>Definition:</i> Process should include the following:</p> <ul style="list-style-type: none"> • identify and describe stud spacing requirements for wall framing • utilize construction plans to layout wall stud locations on 16" or 24" centers as indicated on a construction plan <p>Process/Skill Questions</p>
<p>S 020: Cut wall plate components</p> <p><i>Definition:</i> Process should include the following:</p> <ul style="list-style-type: none"> • verify rough openings, corners, and wall tee locations for framing the walls of a house • layout and cut framing components according to construction plans • cut door and window openings to proper width within +/-1/16" <p>Process/Skill Questions</p>
<p>S 030: Cut wall framing components (headers, sills, and full, jack, and cripple studs) (CF)</p> <p><i>Definition:</i> Process should include the following:</p> <ul style="list-style-type: none"> • utilize construction plans to determine wall component lengths • cut wall framing components to proper length within +/- 1/16" <p>Process/Skill Questions</p>
<p>S 040: Assemble and install corner post and T-posts</p> <p><i>Definition:</i> Process should include the following:</p> <ul style="list-style-type: none"> • assemble corner and T- post components for wall construction • install blocking flush with sides and square with T- post ends • install corner posts and T-posts plumb and square with the structure <p>Process/Skill Questions</p>
<p>S 050: Assemble headers for doors and windows (CF)</p> <p><i>Definition:</i> Process should include the following:</p> <ul style="list-style-type: none"> • calculate header component dimensions for window and door installation • cut windows and door header components square and to correct length within +/- 1/16" • fabricate headers for door and window construction <p>Process/Skill Questions</p>

S 060: Frame door & window openings**(CF)***Definition:* Process should include the following:

- calculate door & window frame components for fabrication
- use header and door/window components to frame door and window openings
- keep door & window frame components flush using proper fasteners
- describe techniques for assuring squareness for door and window frame openings

Process/Skill Questions

S 070: Assemble wall sections**(CF)***Definition:* Process should include the following:

- describe techniques for fastening studs to plates
- assemble wall components according to plate layout, keeping parts flush, within +/- 1/16"
- use industry accepted fastening techniques for fabricating wall sections
- square and brace wall sections to maintain squareness

Process/Skill Questions

S 080: Install double top plate (cap plate)*Definition:* Process should include the following:

- describe methods to tie wall sections and top plates together
- cut double top plate to correct length to break over studs and prevent joint breaking 4" from double top plate joint
- install double top plate flush with intersecting wall overlap
- install top plate using nailing pattern in accordance with industry standards

Process/Skill Questions

S 090: Install wall blocking (backing)*Definition:* Process should include the following:

- describe locations and necessity for wall blocking
- calculate wall blocking dimensions for various installations
- cut and install wall blocking according to local code ensuring all work is flush and appropriate fasteners used

Process/Skill Questions

S 100: Install fire stops

Definition: Process should include the following:

- describe reasons for placing fire stops in the walls of a structure
- calculate fire stop dimensions for installation in various locations of a structure
- describe locations where fire stops are recommended or required
- cut and install fire stops to meet local code requirements

Process/Skill Questions

S 110: Install corner brace

Definition: Process should include the following:

- describe techniques for bracing building corners
- cut corner bracing to length within +/- 1/16" for installation at 45° angle
- install corner brace on wall sections, ensuring proper installation and attachment

Process/Skill Questions

S 120: Install exterior wall sheathing

Definition: Process should include the following:

- describe the purpose for using wall sheathing materials
- describe installation techniques and methods for various wall sheathing material
- describe advantages and disadvantages of various wall sheathing materials
- install wall sheathing materials according to manufacturer's specifications using appropriate fasteners

Process/Skill Questions

S 130: Raise and anchor wall section

Definition: Process should include the following:

- locate position for wall sections according to construction drawings
- describe techniques for raising wall sections into place
- tie wall sections together with appropriate fasteners at correct intervals

Process/Skill Questions

S 140: Plumb, align, and brace wall section

Definition: Process should include the following:

- describe methods to plumb and square corners of wall sections
- describe methods to brace wall sections
- align wall sections with appropriate leveling instruments
- brace wall sections with proper nailing, selecting best angle and length
- plumb and brace corner wall sections

Process/Skill Questions

**DUTY T:
Framing A Ceiling****Task:****T 010: Layout ceiling framing detail**

Definition: Process should include the following:

- determine ceiling framing layout from construction plans
- lay out and mark ceiling joist locations on top plates according to construction plans

Process/Skill Questions

T 020: Cut ceiling joists

Definition: Process should include the following

- calculate ceiling joist measurements from construction plans
- measure and cut joists and trim ends consistent with construction plans within +/- 1/16"

Process/Skill Questions

T 030: Install ceiling joists

Definition: Process should include the following:

- install ceiling joists according to layout in construction plans
- use appropriate fasteners and fabricating methods for installing ceiling joists
- install ceiling joist in accordance with construction plans

Process/Skill Questions

T 040: Frame ceiling opening

Definition: Process should include the following:

- describe methods to brace and support ceiling openings
- describe methods for laying out ceiling openings on ceiling joists
- lay out ceiling opening dimensions on ceiling joists
- install bracing for ceiling openings according to construction plans and local code

Process/Skill Questions

T 050: Install strongback (stiffener or catwalk)

Definition: Process should include the following:

- describe reasons for use of strongbacks in building framing
- calculate dimensions for strongbacks to be installed for various situations
- install strongbacks and fasten according to specifications

Process/Skill Questions

**DUTY U:
Framing A Roof****Task:****U 010: Read roof framing details**

Definition: Process should include the following:

- discuss items used for load calculations for roof framing components
- interpret rafter layout patterns for common, header, and cripple rafters
- interpret truss rafter layout from construction plans
- discuss structural components in common and truss rafter design
- determine type of rafter, pitch, overhang, and spacing from construction plans

Process/Skill Questions

U 020: Lay out common, cripple, jack, and header rafters

Definition: Process should include the following:

- follow construction drawings to layout roof framing on top plates
- compute common rafter lengths for cutting, including overhang and layout for a specified pitch and birds mouth
- compute cripple rafter length for cutting to include overhang and layout for a specified pitch and birds mouth
- compute jack rafter length for cutting to include overhang and layout for a specified pitch and birds mouth
- layout rafters for a specified pitch, overhang, and birdsmouth

Process/Skill Questions

U 030: Lay out truss rafters

Definition: Process should include the following:

- follow construction drawings to layout roof framing on top plates
- compute truss rafter lengths for cutting, including overhang and layout for a specified pitch and birdsmouth
- layout truss rafters for a specified pitch, overhang, and birdsmouth

U 040: Reproduce common and truss rafters from a pattern (CF)

Definition: Process should include the following:
cut rafter

- describe reproduction techniques of common and truss rafters from a pattern
- cut common and truss rafter components
- reproduce common and truss rafters to length including overhang

Process/Skill Questions

U 050: Install ridge board

Definition: Process should include the following:

- describe installation methods for a ridge board
- measure and cut ridge board with 90° ends
- install and brace ridge board for rafter installation

Process/Skill Questions

U 060: Frame roof opening

Definition: Process should include the following:

- describe methods to layout, brace and support roof openings
- lay out ceiling openings with necessary dimensions on ceiling joists
- describe methods to set lower header plumb and upper header at right angles to the roof slope for dormers
- install necessary bracing with plumb headers, beveled for slope, with appropriate clearance according to construction plans and local code

Process/Skill Questions

U 070: Install common, cripple and jack rafters

Definition: Process should include the following:

- describe techniques for handling and installing common, cripple and jack rafter components
- install common, cripple and jack rafters in proper position from construction plans using appropriate fasteners

Process/Skill Questions

U 080: Install truss rafters

Definition: Process should include the following:

- describe techniques for handling and installing truss rafter components
- install truss rafters, plumb and in proper position using appropriate fasteners

Process/Skill Questions

U 090: Frame gable end overhang

Definition: Process should include the following:

- discuss construction of gable overhang for common rafter systems
- discuss construction of gable overhang for truss rafter systems
- construct overhang for a common rafter system according to construction plans
- construct overhang for a truss rafter system according to construction plans

Process/Skill Questions

U 100: Install collar beams (rafter ties)

Definition: Process should include the following:

- calculate collar beam dimensions and location on common rafters
- layout collar beam based on dimensions from construction plans
- cut collar beam to length within +/- 1/16" and within an angle of +/- 1°
- position and install collar beam on common rafters

Process/Skill Questions

U 110: Install purlins

Definition: Process should include the following:

- describe methods to install purlins on a common rafter system
- discuss reasons for positioning purlin plate over load-bearing partition
- cut purlins to length within +/- 1/16" with correct angle of +/- 1°
- position and install purlin as specified within +/- 1/8"

Process/Skill Questions

U 120: Install roof sheathing

Definition: Process should include the following:

- describe nailing patterns used for various roof sheathing materials
- describe layout patterns used when installing roof sheathing
- describe techniques to align roof sheathing on rafter center with roof sheathing face grain perpendicular to rafters in accordance with manufacturer's instructions

Process/Skill Questions

**DUTY V:
Installing Roofing****Task:****V 010: Install roofing underlayment**

Definition: Process should include the following:

- discuss reasons for using roofing underlayment.
- identify various products used for roofing underlayment.
- install and nail roofing underlayment according to manufacturer's specifications

Process/Skill Questions

V 020: Install roof flashing

Definition: Process should include the following:

- discuss the reason various locations need roof flashing
- identify various roof flashing materials and shapes
- describe special considerations for flashing materials for roof openings
- describe methods for attaching roof flashing material to a structure
- install roof flashing materials according to manufacturer's specifications

Process/Skill Questions

V 030: Install roofing shingles

Definition: Process should include the following:

- describe various types of shingles and shingle materials available
- describe various shingling patterns used for applying shingles
- describe nailing patterns and procedures used in applying shingles
- demonstrate specialized tools and equipment for installing and trimming shingles
- install standard composite shingles flush to surface with nail pattern to manufacturer's specifications

Process/Skill Questions

V 040: Install ridge cap shingles

Definition: Process should include the following:

- describe reasons for ridge cap installation patterns
- describe methods for installing ridge cap shingles in various locations on a roof
- lay out, cut, and, install ridge cap with appropriate overlap
- apply sealant to exposed nails and fasteners after installation of ridge cap shingles

Process/Skill Questions

V 050: Install composite shingles in valley

Definition: Process should include the following:

- describe reasons for installation patterns of shingles in roof valleys
- describe installation and nailing patterns accepted for shingle installation in a valley
- align & install shingles in a valley according to manufacturer's specifications

Process/Skill Questions

V 060: Install composite shingles around roof openings

Definition: Process should include the following:

- describe installation patterns accepted in industry for shingle installation at roof openings
- describe special consideration for shingle installation near roof flashing
- install composite shingles around roof opening, tight with no leakage, ensuring nails do not pierce flashing

Process/Skill Questions

**DUTY W:
Construct and Install Stairs****Task:****W 010: Calculate rise and run for stairs**

Definition: Process should include the following:

- discuss various stair designs, characteristics, terminology, and uses
- describe construction methods for various stair designs
- verify rough opening width, total rise and total run for stair construction
- calculate individual rise heights and run lengths needed for layout of stair stringers
- calculate finished dimensions for riser and tread components

Process/Skill Questions

W 020: Lay out straight run stair stringer

Definition: Process should include the following:

- lay out a stair stringer using framing square and square gauges to dimensions within +/- 1/16"
- lay out a stair stringer for 2nd floor header and 1st floor landing using framing square and square gauges with an accuracy of +/-1/16"
- explain special layout considerations for finish floor, nosing, etc.
- lay out riser and tread components

Process/Skill Questions

W 030: Cut stair component

Definition: Process should include the following:

- cut stringers, risers, and treads for stairs to correct dimensions within +/- 1/32"
- cut stringer for 2nd floor header and 1st floor landing to correct dimension within +/- 1/32"

Process/Skill Questions

W 040: Construct and install stair unit

Definition: Process should include the following:

- assemble and install assembled stair unit in rough opening using appropriate fasteners
- verify finished stair dimensions comply with design criteria

Process/Skill Questions

CONCRETE MASONRY**DUTY X:****Identify Concrete Materials****Task:****X 010: Identify materials used to manufacture concrete**

Definition: Process should include the following:

- identify basic raw materials used in manufacturing concrete
- describe the proportion of materials commonly used in manufacturing concrete
- describe characteristics obtained by varying material proportions in manufacturing concrete

Process/Skill Questions

X 020: Identify properties of Portland cement

Definition: Process should include the following

- identify basic raw materials used in manufacturing Portland cement
- identify types and uses of Portland cement
- describe properties suitable for cement to be used in manufacturing concrete

Process/Skill Questions

X 030: Identify properties of water used to manufacture concrete

Definition: Process should include the following

- identify properties of water that are necessary for use in manufacturing concrete
- describe the importance of water/cement ratio in manufacturing concrete
- describe effects of using unsuitable water for manufacturing concrete

Process/Skill Questions

X 040: Identify types and uses of aggregates for concrete

Definition: Process should include the following:

- identify properties of concrete aggregates that are necessary for use in manufacturing concrete
- describe the categories of concrete aggregate sizes and their definitions
- describe the classes of artificial concrete aggregates and the materials in each class

Process/Skill Questions

X 050: Identify types and uses of admixtures for concrete

Definition: Process should include the following:

- identify common admixture classes used in manufacturing concrete
- describe the function of common admixture classes used in manufacturing concrete

Process/Skill Questions

DUTY Y:
Using Concrete Tools

Task:

Y 010: Identify hand tools used for working with concrete

Definition: Process should include the following:

- identify uses for common hand tools used for working with concrete
- select proper hand tools for specific tasks when working with concrete
- describe the purpose of various special hand tools used in placing and finishing concrete
- demonstrate the use of common hand tools for working with concrete

Process/Skill Questions

Y 020: Identify power tools used for working with concrete

Definition: Process should include the following:

- identify uses for common power tools used for working with concrete
- select proper power tools for specific tasks when working with concrete
- describe the purpose of various power tools used in finishing concrete
- demonstrate the use of power tools for working with concrete

Process/Skill Questions

**DUTY Z:
Performing Concrete Layout****Task:****Z 010: Identify concrete measuring and layout tools**

Definition: Process should include the following:

- identify tools used in measuring and layout for the placement of concrete
- describe uses for measuring and layout tools used in placing concrete
- use measuring and layout tools for the placement of concrete

Process/Skill Questions

Z 020: Layout of concrete slabs

Definition: Process should include the following:

- describe the procedures to layout straight lines and corners for a concrete slab
- demonstrate procedures for using a level in concrete layout
- demonstrate procedures for layout of straight lines for a concrete slab
- demonstrate procedures for layout of corners for a concrete slab
- describe errors to avoid when laying out concrete slabs
- perform the layout of a simple concrete slab

Process/Skill Questions

Z 030: Using concrete forms

Definition: Process should include the following:

- identify types of concrete forms commonly used in residential construction
- describe purposes for different types of concrete forms
- describe techniques for set-up of engineered concrete forming systems
- describe techniques for building concrete forms
- build or set-up concrete forms for the placement of a concrete slab
- describe techniques for removal of concrete forms
- demonstrate the setup of an engineered concrete forming system
- demonstrate the removal of forms from concrete

Process/Skill Questions

DUTY AA:

Techniques for Placing and Finishing Concrete

Task:

AA 010: Placing concrete in forms

Definition: Process should include the following:

- describe the difference between placing and rodding concrete
- identify steps in the process of placing concrete in forms
- demonstrate the placement of concrete in forms for a concrete slab
- demonstrate the placement of concrete in forms for a concrete sidewalk

Process/Skill Questions

AA 020: Placing concrete for footings and foundations

Definition: Process should include the following:

- identify steps in the process of placing concrete for residential footings and foundations
- describe preparation necessary for pouring a concrete footing for residential construction
- demonstrate the placement of concrete for a footing for residential construction
- demonstrate the placement of concrete in forms for a residential concrete foundation wall

Process/Skill Questions

AA 030: Finishing concrete

Definition: Process should include the following:

- describe factors to consider prior to beginning the finishing process on concrete
- identify steps to take in the finishing of concrete
- identify the purpose for control joints in concrete structures
- demonstrate techniques for using hand finishing tools on a concrete slab
- demonstrate techniques for placing control joints in a concrete slab or sidewalk
- describe the process for using a power trowel for finishing a concrete slab

Process/Skill Questions

DRYWALL

DUTY BB:

Identify Drywall Materials

Task:

BB 010: Identify characteristics of drywall materials

Definition: Process should include the following:

- identify types of drywall materials used in residential and commercial construction
- describe benefits of using drywall materials in residential construction
- identify common sizes of drywall materials
- describe situations for use of drywall in combination with other construction materials

Process/Skill Questions

BB 020: Identify Fasteners for drywall materials

Definition: Process should include the following:

- identify types of fasteners used with drywall material
- describe installation methods used for various fasteners for drywall materials

Process/Skill Questions

DUTY CC:

Using Drywall Tools

Task:

<p>CC 010: Identify tools for hanging drywall materials</p> <p><i>Definition:</i> Process should include the following:</p> <ul style="list-style-type: none"> • identify tools used for the installation of drywall materials • describe the use of various tools for installing drywall materials • describe specialized tools made for installing drywall materials <p>Process/Skill Questions</p>
<p>CC 020: Tools and materials for finishing drywall joints</p> <p><i>Definition:</i> Process should include the following:</p> <ul style="list-style-type: none"> • identify types of tools used for finishing drywall joints • identify materials used to fill and reinforce drywall joints • describe techniques used to finish drywall joints <p>Process/Skill Questions</p>
<p>DUTY DD: Performing Drywall Layout</p>
<p>Task:</p>
<p>DD 010: Layout of drywall materials</p> <p><i>Definition:</i> Process should include the following:</p> <ul style="list-style-type: none"> • identify tools used for the layout of drywall materials • describe techniques for measuring drywall material for installation • determine dimensions for installation of drywall materials • describe methods used to layout and cut drywall material • demonstrate the layout and cutting of drywall material <p>Process/Skill Questions</p>
<p>DUTY EE: Techniques for Hanging and Finishing Drywall</p>
<p>Task:</p>

EE 010: Installing Drywall Materials

Definition: Process should include the following:

- describe conditions necessary in a building's framing to accept drywall materials
- describe techniques for installation of drywall materials with hand tools
- describe techniques for installation of drywall materials with a screwgun
- describe the causes of improper installation of drywall materials
- describe materials used to reinforce corners on drywall materials
- install drywall material on structure framing members
- install reinforcement on corners of drywall materials

Process/Skill Questions

EE 020: Finishing Drywall Materials

Definition: Process should include the following:

- identify special tools used to finish drywall materials
- describe methods and materials used to reinforce joints in drywall installation
- identify materials used to fill joints and finish drywall
- describe techniques for finishing drywall joints and corners
- install joint reinforcement in drywall
- install corner reinforcement in drywall
- float and finish drywall joints and corners
- prepare drywall surfaces to receive paint and textured finishes

Process/Skill Questions

EE 030: Applying textured finishes to drywall

Definition: Process should include the following:

- identify tools used to apply textured finishes to drywall materials
- identify materials used for textured finishes on drywall in residential construction
- describe techniques for applying textured finishes to drywall materials
- demonstrate the application of textured finishes to drywall materials

Process/Skill Questions

EE 040: Application of textured finishes on drywall ceilings

Definition: Process should include the following:

- identify special tools used to apply textured finishes to drywall on ceilings
- identify materials used for textured finishes on drywall ceilings in residential construction
- describe techniques for applying and forming textured surfaces on drywall ceilings
- demonstrate the application of textured finishes for drywall ceilings

Process/Skill Questions

ELECTRICITY

DUTY FF:

Applying Basic Electrical Theory

Task:

FF 010: Explain electron theory and the relationship to circuit design using Ohm's Law

- *Definition:* Process should include the following:
- identify and define the parts of an atom as applied to electron flow
- explain relationships for voltage, current, and resistance in an electrical circuit
- solve for unknown values for voltage, current, and resistance in an electrical circuit
- explain the electrical relationships described in Ohm's Law

Process/Skill Questions

DUTY GG:

Identify Tools used in the Electrical Field

Task:

GG 010: Identify hand tools used for working with electricity (FC)

Definition: Process should include the following:

- identify uses for common hand tools used in the electrical field
- identify uses for specialized hand tools used for working with electricity
- select proper hand tools for specific tasks related to working with electricity

Process/Skill Questions

GG 020: Identify power tools used for working with electricity

Definition: Process should include the following:

- identify uses for common power tools used in the electrical field
- identify uses for specialized power tools used for working with electricity
- select proper power tools for specific tasks related to working with electricity

Process/Skill Questions

DUTY HH:

Safe Practices for Working with Electricity

Task:

HH 010: Identify safe practices for hand tools when working with electricity (CF)

Definition: Process should include the following:

- inspect tools and worksite for existing or potential shock hazards
- demonstrate knowledge of guidelines for the use of hands tools when working with electricity
- identify potential electrical hazards when working with hand tools around electricity

Process/Skill Questions

HH 020: Identify safe practices for electric power tools when working with electricity

Definition: Process should include the following:

- review procedures for checking power tools for potential electrical hazards
- describe safe working practices for use of power tools when working around electricity
- demonstrate an awareness of industry standards, manufacturers' specifications, and instructor guidelines for working around electricity with power tools
- assure electric power tools are in good working condition relating to electrical hazards

Process/Skill Questions

HH 030: Describe electrical lockout/tagout procedures

Definition: Process should include the following:

- identify different types of lockout/tagout equipment and labels
- explain proper lockout/tagout procedures according to industry standards and instructor guidelines
- discuss reasons for establishing lockout/tagout procedures

Process/Skill Questions

HH 040: Explain safe working practices related to electrical hazards

Definition: Process should include the following:

- identify equipment used to test wiring in electrical circuits
- inspect workspace for safe working conditions necessary for wiring circuits
- demonstrate safe habits for wiring electrical circuits
- develop an awareness of National Electrical Code Standards for working with electricity

Process/Skill Questions

HH 050: Demonstrate safe housekeeping procedures for working with electricity

Definition: Process should include the following:

- describe methods to provide adequate lighting for work area
- describe reasons for immediate cleanup of spilled liquids from the electrical work area
- describe procedures to store liquids and other materials regarding electrical hazards
- show awareness of industry standards, manufacturer specifications, and instructor guidelines for working with electricity

Process/Skill Questions

**DUTY II:
Using Tools And Materials in the Electrical Field****Task:****II 010: Demonstrate the safe use of hand tools when working with electricity (CF)**

Definition: Process should include the following:

- demonstrate the correct use for common hand tools used in the electrical field
- identify maintenance associated with hand tools used for working with electricity

Process/Skill Questions

II 020: Demonstrate the safe use of power tools when working with electricity

Definition: Process should include the following:

- identify the correct use for power tools used in the electrical field
- identify maintenance associated with power tools used for working with electricity

Process/Skill Questions

II 030: Use Digital Volt Ohm Meters (DVOM) to take readings on electrical circuits

Definition: Process should include the following:

- describe the purpose for various scales of a digital volt/ohm meter (DVOM).
- set and adjust a DVOM for specified tests or measurements (i.e., voltage, amperage resistance, and continuity)
- demonstrate the ability to read various scales correctly on a DVOM meter
- utilize a DVOM to determine unknown parameters for voltage, current, and resistance in a branch electrical circuit
- utilize a DVOM to verify calculations for theoretical values for voltage, current, and resistance in a branch circuit
- use a DVOM to test for continuity in a branch circuit

Process/Skill Questions

II 040: Maintain an electrical component inventory

Definition: Process should include the following:

- identify electrical components and materials used in residential construction
- describe the function for various electrical components and materials used in residential construction

Process/Skill Questions

DUTY JJ:

Characteristics of Electrical Circuits

Task:

JJ 010: Calculate electrical loads in series circuits

Definition: Process should include the following:

- describe characteristics of series circuits
- explain relationships for voltage, current, resistance, and wattage found in typical residential series circuits, using Ohm's Law
- solve unknown values for voltage, current, resistance, and wattage in series circuits, using Ohm's Law

Process/Skill Questions

JJ 020: Wire series circuits (CF)

Definition: Process should include the following:

- fabricate typical residential series circuits conforming to accepted trade practices and NEC code guidelines

Process/Skill Questions

JJ 030: Troubleshoot series circuits

Definition: Process should include the following:

- use appropriate methods and meters to troubleshoot typical residential series circuits following accepted trade practices and NEC code guidelines

Process/Skill Questions

JJ 040: Calculate electrical loads in parallel circuits

Definition: Process should include the following:

- describe characteristics of parallel circuits
- explain relationships for voltage, current, resistance, and wattage in typical residential parallel circuits, using Ohm's Law
- solve unknown values for voltage, current, resistance, and wattage for typical residential parallel circuits, using Ohm's Law

Process/Skill Questions

**JJ 050: Wire parallel circuits
(FC)**

Definition: Process should include the following:

- fabricate typical residential parallel circuits conforming to accepted trade practices and NEC code guidelines

Process/Skill Questions

JJ 060: Troubleshoot parallel circuits

Definition: Process should include the following:

- use appropriate methods and meters to troubleshoot typical residential parallel circuits following accepted trade practices and NEC code guidelines

Process/Skill Questions

**DUTY KK:
Navigating the National Electrical Code (NEC) Book****Task:****KK 010: Explain intent of the National Electrical Code (NEC) (Article 90)**

Definition: Process should include the following:

- discuss purpose, scope, intent, enforcement, code arrangement, and history of the NEC
- discuss purpose, scope, and intent, of NEC Article 90

Process/Skill Questions

KK 020: Interpret the NEC requirements for electrical installation

Definition: Process should include the following:

- use NEC guidelines to calculate general job requirements for residential wiring methods

Process/Skill Questions

**DUTY LL:
Installing Conduit**

Task:
LL 010: Describe types and sizes of electrical conduit <i>Definition:</i> Process should include the following: <ul style="list-style-type: none"> • describe common uses for the following types of electrical conduit; ridged steel, ridged plastic or PVC, aluminum, EMT, IMC rigid • describe standard sizes for the following types of electrical conduit; ridged steel, ridged plastic or PVC, aluminum, EMT, IMC rigid Process/Skill Questions
LL 020: Describe types of fittings and connections used with electrical conduit <i>Definition:</i> Process should include the following: <ul style="list-style-type: none"> • describe typical connections used with ridged steel, aluminum, IMC, PVC, and EMT conduit • identify types of fittings for ridged steel, aluminum, IMC, PVC, and EMT conduit and where they are used Process/Skill Questions
LL 030: Identify benders and the bending process used with electrical conduit <i>Definition:</i> Process should include the following: <ul style="list-style-type: none"> • explain reasons for bending electrical conduit • describe equipment used for bending various types of electrical conduit • describe techniques for bending various types of electrical conduit Process/Skill Questions
DUTY MM:
Installing Electrical Conductors
Task:
MM 010: Identify various types of conductors used for electrical service <i>Definition:</i> Process should include the following: <ul style="list-style-type: none"> • describe types of conductors typically used for residential electrical service • describe types of electrical insulation typically used on residential electrical conductors • identify uses for various types of conductors for residential electrical service (copper, aluminum, and copper-clad conductors) • determine size of electrical conductors needed for electrical service (determined by using stripper or AWG) Process/Skill Questions

MM 020: Select and install conductors for residential electrical service

Definition: Process should include the following:

- select correct type and size conductor for branch electrical circuits in accordance with NEC guidelines
- wire branch electrical circuits for residential electrical purposes using accepted industry practices & NEC guidelines
- wire special purpose outlets using accepted industry practices & NEC guidelines
- test electrical circuits using accepted testing procedures in accordance with NEC guidelines
- demonstrate methods for stabilizing conductors in a residential installation

Process/Skill Questions

MM 030: Use lugs, connectors, and terminals to make connections for electrical service

Definition: Process should include the following:

- install branch circuit outlets and switches on structural members using accepted procedures in accordance with NEC guidelines
- strip conductors using accepted industry standards and NEC guidelines
- install lugs, connectors, and terminals in accordance with manufacturer's specifications
- configure wire in branch outlet and switch boxes using accepted procedures in accordance with NEC guidelines

Process/Skill Questions

DUTY NN:**Installing Panel Boards and Switchboards****Task:****NN 010: Install an electrical service panel**

Definition: Process should include the following:

- install an electrical service panel for residential use in accordance with NEC guidelines, including service disconnect
- install grounding conductors for a building grounding system in accordance with manufacturer and NEC guidelines
- complete electrical service panel installation in accordance with manufacturer and NEC guidelines

Process/Skill Questions

NN 020: Identify the purpose and location of over current devices (OCD's)

- *Definition:* Process should include the following:
- list the areas where OCD's may be located in residential and commercial facilities
- identify location of OCD's on structural plans, appliance wiring diagrams, and various available equipment diagrams
- differentiate between a short circuit and an overload
- describe the condition of a blown fuse after a short or overload according to NEC standards

Process/Skill Questions

NN 030: Select over current devices (OCD's)

- Definition:* Process should include the following:
- identify types of OCD's used for residential system wiring
 - identify types of circuit breakers used in single phase electrical systems (single-pole 120V, double-pole 208V/240V)
 - utilize NEC guidelines to determine the correct type OCD for use in existing and new installations

Process/Skill Questions

NN 040: Install over current devices (OCD's)

- Definition:* Process should include the following:
- Remove and replace a fuse in an assigned piece of equipment (e.g., disconnect box, pullout block)
 - Remove and replace single-pole and double-pole OCD breakers in single-phase panels
 - complete OCD installations in accordance with manufacturer and NEC

Process/Skill Questions

NN 050: Install ground fault circuit-interrupter (GFCI) devices

- Definition:* Process should include the following:
- identify types of ground fault circuit-interrupter devices used in residential electrical systems.
 - identify a breaker-type and receptacle-type GFCI
 - identify a feed-through receptacle and end of line (EOL) type receptacle GFCI
 - connect a GFCI breaker in a single-phase service panel
 - connect a GFCI receptacle as feed-through, in-line, and EOL on specified circuits
 - utilize installation methods identified by manufacturer and NEC guidelines for GFCI

Process/Skill Questions

DUTY OO: Installing Grounding Systems
Task:
OO 010: Describe characteristics of electrical grounding systems <i>Definition:</i> Process should include the following: <ul style="list-style-type: none"> • explain the purpose of grounding for a building's electrical circuit • distinguish between a short circuit and a ground fault • define the term "ground circuit" • explain requirements for physical protection for the grounding electrode conductor • explain what happens in a grounding electrode system when a short circuit occurs • explain the use of a main bonding jumper • explain the purpose of the grounded conductor • explain requirements for grounding sub-panels accord to the latest NEC guidelines Process/Skill Questions
OO 020: Demonstrate sizing, layout, and installation of grounding systems <i>Definition:</i> Process should include the following: <ul style="list-style-type: none"> • explain how to install a grounding system for a dwelling with 10 feet of metal pipe • explain how to install a grounding system for a dwelling with no metal pipe • explain how to install a grounding system between a main panel and a sub panel • use NEC Section 250-52 to select grounding electrodes • use NEC Table 250-66 to select grounding conductors for raceways and equipment according to the latest NEC guidelines Process/Skill Questions
DUTY PP: Electrical Prints and Specifications
Task:
PP 010: Develop electrical plans <i>Definition:</i> Process should include the following: <ul style="list-style-type: none"> • place common switches, convenience and special purpose outlets, and wiring in their appropriate positions on a floor plan, using accepted drafting standard symbols and NEC guidelines Process/Skill Questions

PP 020: Interpret electrical plans and specifications

Definition: Process should include the following:

- identify electrical components used in construction as shown on construction plans
- develop an electrical material and component list from plans and specifications

Process/Skill Questions

PLUMBING**DUTY QQ:****Practicing Safety on the Plumbing Job Site****Task:****QQ 010: Describe chemical risks associated with plumbing occupations, referencing Material Safety Data Sheets**

Definition: Process should include the following:

- described common chemical hazards associated with the plumbing occupation (e.g., primers, acids, cement, flux, and pipe joint compound, as well as others listed in MSDS).

Process/Skill Questions

DUTY RR:**Introducing the Plumbing Trade****Task:****RR 010: Discuss the historical development of the plumbing trade**

Definition: Process should include the following:

- discuss historical landmarks in the development of the plumbing trade, beginning with its origins (4000 B.C.)
- discuss the impact of Roman aqueducts on features of modern plumbing systems
- discuss sanitation problems of the Middle Ages
- outline and discuss the development of modern sanitation systems

Process/Skill Questions

RR 020: Describe the importance of plumbers in modern society

Definition: Process should include the following:

- describe how the plumbing trade relates to sanitation and public health
- describe how improper plumbing and sanitation impacts environmental quality

Process/Skill Questions

RR 030: Describe the functions of water supply systems**(CF)***Definition:* Process will include the following:

- describe the importance of clean water and its relationship to human health and life span
- describe ways a residential water supply system can be contaminated

Process/Skill Questions

RR 040: Describe the functions of sewage treatment systems**(CF)***Definition:* Process will include the following:

- describe the components in a residential sewage disposal system
- identify environmental impacts of improper sewage discharge

Process/Skill Questions

DUTY SS:**Math in the Plumbing Trade****Task:****SS 010: Measure various pipe dimensions****(CF)***Definition:* Process should include the following:

- demonstrate the ability to read a rule accurately to within +/- 1/32"
- measure pipe end-to-end, center-to-center, face-to-face, or in other ways typically used in the plumbing industry
- describe methods of sizing and specifying various types of pipe used in plumbing.

Process/Skill Questions

SS 020: Perform mathematical calculations related to plumbing using feet and inches as the units of measure**(CF)***Definition:* Process should include the following:

- calculate accurately in accordance with plumbing industry guidelines
- perform addition, subtraction, and conversion commonly used in the plumbing industry

Process/Skill Questions

SS 030: Calculate area and volume related to plumbing*Definition:* Process should include the following:

- calculate the area of various shaped spaces
- calculate the volume of various shaped spaces
- calculate the volume of liquid a round or square tank can hold

Process/Skill Questions

<p>SS 040: Calculate fitting allowance</p> <p><i>Definition:</i> Process should include the following:</p> <ul style="list-style-type: none"> • discuss reasons for fitting allowances used on plumbing • calculate the fitting allowance for plumbing fittings <p>Process/Skill Questions</p>
<p>Duty TT: Interpret Plumbing Construction Drawings</p>
<p>Task:</p>
<p>TT 010: Identify plumbing fixtures depicted on plumbing construction drawings</p> <p><i>Definition:</i> Process should include the following:</p> <ul style="list-style-type: none"> • identify standard fixtures on a residential construction drawing • identify standard fixtures on a commercial construction drawing <p>Process/Skill Questions</p>
<p>TT 020: Develop fitting/material lists based on plumbing construction drawings</p> <p><i>Definition:</i> Process should include the following:</p> <ul style="list-style-type: none"> • develop fitting/material lists from construction drawings • calculate piping necessary to connect fixtures based on construction drawings • verify that plumbing fixture clearances meet code standards • calculate the cost of plumbing materials for various rooms or jobs. <p>Process/Skill Questions</p>
<p>TT 030: Interpret an isometric plumbing drawing</p> <p><i>Definition:</i> Process should include the following:</p> <ul style="list-style-type: none"> • describe notes and dimensions used on isometric plumbing drawings • identify fixture and material symbols used on isometric plumbing drawings • compare isometric plans to floor plans and other construction drawings <p>Process/Skill Questions</p>
<p>DUTY UU: Identify Tools Used in the Plumbing Industry</p>
<p>Task:</p>

UU 010: Identify hand tools used for working in the plumbing industry (CF)

Definition: Process should include the following:

- identify uses for common hand tools in the plumbing industry
- identify uses for specialized hand tools in the plumbing industry
- select proper hand tools for specific tasks for working in the plumbing industry

Process/Skill Questions

UU 020: Identify power tools used for working with plumbing

Definition: Process should include the following:

- identify uses for common power tools in the plumbing industry
- identify uses for specialized power tools in the plumbing industry
- select proper power tools for specific tasks for working in the plumbing industry

Process/Skill Questions

**DUTY VV:
Cutting and Joining Pipe**

Task:

VV 010: Cut cast iron pipe

Definition: Process should include the following:

- cut cast iron pipe to length within $\pm 1/16$ " in accordance with industry guidelines
- demonstrate techniques to cut cast iron pipe square, in a manner to prevent crushing

Process/Skill Questions

VV 020: Cut and deburr copper tubing

Definition: Process should include the following:

- cut copper tubing with a tubing cutter to correct length within $\pm 1/16$ "
- use deburring tool on copper tubing according to industry guidelines

Process/Skill Questions

VV 030: Cut plastic pipe with PVC/ABS saw or approved cutter (CF)

Definition: Process should include the following:

- cut PVC/ABS pipe with approved cutting tool, with end square, and to correct length within $\pm 1/16$ "
- cut pipe with hack saw, with end square, and to correct length within $\pm 1/16$ "
- perform deburring on PVC/ABS pipe in accordance with industry guidelines

Process/Skill Questions

VV 040: Cut & ream steel pipe

Definition: Process should include the following:

- cut steel pipe to proper length within $\pm 1/16$ " using hand pipe cutters
- cut steel pipe to proper length within $\pm 1/16$ " using power pipe cutters
- ream steel pipe according to industry guidelines

Process/Skill Questions

VV 050: Join cast iron pipe using rubber-type seal and no-hub connectors

Definition: Process should include the following:

- align cast iron pipe to receive connector
- assure band and seal are aligned prior to tightening connector
- ensure no-hub connector is torqued according to plumbing code

Process/Skill Questions

VV 060: Construct copper pipe (tubing) assembly using solder joints

Definition: Process should include the following:

- clean pipe using sandpaper or wire brush
- apply flux with brush to fittings and pipe
- apply heat for solder according to industry guidelines
- apply solder to joint according to industry guidelines
- test piping assembly for leaks
- wipe excess flux from joint after assembly cools

Process/Skill Questions

VV 070: Join plastic pipe (tubing) to fittings using solvent method (CF)

Definition: Process should include the following:

- identify primer/cement/solvent types used for various piping materials
- apply primer/cement/solvent to pipe and fittings according to industry guidelines
- insert pipe and assemble joints according to industry guidelines
- test piping assembly for leaks

Process/Skill Questions

VV 080: Join copper pipe (tubing) using compression fittings

Definition: Process should include the following:

- identify uses for various compression fittings for copper pipe
- clean compression fitting and pipe according to industry guidelines
- tighten compression fitting according to manufacturer's specifications
- test piping assembly for leaks

Process/Skill Questions

VV 090: Join copper pipe (tubing) to fittings using flare method

Definition: Process should include the following:

- use a flaring tool and block to prepare a flare joint on copper pipe
- select appropriate flare fitting for use on copper pipe
- clean fitting and pipe for a flare joint according to industry guidelines
- tighten flare fitting according to manufacturer's specifications
- test piping assembly for leaks

Process/Skill Questions

VV 100: Join plastic pipe (tubing) to fittings using crimp ring method

Definition: Process should include the following:

- select tools for use with crimp ring method of joining plastic pipe
- identify uses for crimp ring fittings for copper pipe
- clean fitting and pipe according to industry guidelines
- install crimp ring according to manufacturer's specifications
- test piping assembly for leaks

Process/Skill Questions

VV 110: Join plastic pipe (tubing) to fittings using clamp/insert fittings method

Definition: Process should include the following:

- select tools for use with clamp/insert fitting method
- identify uses for clamp/insert fitting for copper pipe
- clean clamp/insert fitting and pipe according to industry guidelines
- install clamp/insert fitting according to manufacturer's specifications
- test piping assembly for leaks

Process/Skill Questions

VV 120: Join pipe with flexible sleeve couplings

Definition: Process should include the following:

- clean fitting and pipe to receive flexible sleeve couplings according to industry guidelines
- identify uses for flexible sleeve couplings for copper pipe
- install and torque flexible sleeve couplings according to industry guidelines
- test piping assembly for leaks

Process/Skill Questions

VV 130: Thread steel pipe with power-driven thread cutter

Definition: Process should include the following:

- set up and install dies for threading steel pipe with power driven thread cutter
- produce pipe with typical threads used in the plumbing industry
- clean up and deburr threads on steel pipe threaded with power driven thread cutter

Process/Skill Questions

VV 140: Thread steel pipe using hand thread cutter and oilers

Definition: Process should include the following:

- set up and install dies for threading steel pipe with hand thread cutter and oiler
- produce pipe with typical threads used in the plumbing industry
- clean up and deburr threads on steel pipe threaded with hand thread cutter and oilers

Process/Skill Questions

VV 150: Join pipe of dissimilar materials

Definition: Process should include the following:

- discuss methods and situations to connect piping of dissimilar materials
- join pipe of dissimilar materials according to industry guidelines
- test piping of dissimilar materials for leaks

Process/Skill Questions

DUTY WW:**Supporting and Hanging Pipe****Task:**

WW 010: Identify types of anchors and straps for commercial plumbing applications.

Definition: Process should include the following:

- list types of anchors and straps used in attaching and hanging plumbing (including expansion anchors, inserts, Red Head anchors, clevis hangers, split-ring hangers, beam clamps, riser clamps, wire hooks, perforated straps, and tube straps)
- explain plumbing code requirements associated with use of hangers and anchors

Process/Skill Questions

WW 020: Install backing and ledger supports for plumbing fixtures

Definition: Process should include the following:

- cut backing and ledger to correct size using appropriate material to fit snugly in space
- install backing and ledger supports properly positioned and level
- check assembly for solid attachment to frame of structure

Process/Skill Questions

WW 030: Install pressure piping, using various supports, including wire pipe hooks, tube talon, or tube straps

Definition: Process should include the following:

- discuss reasons for spacing guidelines with various hangers
- space hangers according to manufacturer's guidelines for a specific application
- install according to manufacturer's guidelines

Process/Skill Questions

WW 040: Install DWV (drainage, waste, and vent) pipe, using various types of supports (e.g., perforated strap, pipe hooks, and riser clamps)

Definition: Process should include the following:

- discuss reasons for accurate grade (slope) for DWV piping
- grade (slope) DWV piping according to code and industry guidelines
- install appropriate supports for DWV pipe according to manufacturer's guidelines

Process/Skill Questions

WW 050: Describe the correct installation of pipe sleeves through a concrete or masonry wall

Definition: Process should include the following:

- describe the installation of pipe sleeves through a concrete or masonry wall
- describe procedure for caulking of sleeve according to industry guidelines

Process/Skill Questions

DUTY XX: Install Waste and Soil Pipes
Task:
XX 010: Rough-in a DWV (drainage, waste, and vent) pipe assembly of PVC/ABS piping <i>Definition:</i> Process should include the following: <ul style="list-style-type: none"> • review the elements in a DWV system to include water closet, lavatory, bathtub, shower, kitchen or bar sink, and washing machine • rough-in a DWV pipe assembly for kitchen, bathroom, or laundry room installation Process/Skill Questions
XX 020: Calculate and set waste and soil pipes <i>Definition:</i> Process should include the following: <ul style="list-style-type: none"> • calculate slope for plumbing runs • describe techniques and instruments used for setting level and slope for waste and soil pipe • install waste and soil pipes according to measurements for level and slope in accordance with plumbing code Process/Skill Questions
XX 030: Install a water closet flange <i>Definition:</i> Process should include the following: <ul style="list-style-type: none"> • lay out measurements for installation of a water closet flange • check layout in accordance with plumbing code, manufacturer's specifications blueprints, and A.D.A. (Americans with Disabilities Act) Process/Skill Questions
XX 040: Describe the use of a backflow valve <i>Definition:</i> Process should include the following: <ul style="list-style-type: none"> • identify situations where backflow prevention devices should be used • describe the purpose for a backflow valve • describe installation techniques for a backflow valve • discuss consequences of faulty installation of a backflow valve Process/Skill Questions

XX 050: Perform a drainage system standing water/air leak test

Definition: Process should include the following:

- describe procedures for a water/air leak test of a drainage system according to the plumbing code
- perform a drainage system water/air leak test according to industry guidelines

Process/Skill Questions

DUTY YY:**Components of a Water Distribution System****Task:****YY 010: Identify procedures and materials for installing a building's water service**

Definition: Process should include the following:

- identify components in a building's water service
- describe procedures for installing a building's water meter
- identify various types of main shutoff valves (e.g., gate, ball, butterfly)
- describe procedures for installing main shutoff valves for a building
- describe advantages for use of various types of main shut off valves
- describe procedures for shutting off and turning on the water supply to a building
- shut off and turn on the water supply to a building

Process/Skill Questions

YY 020: Install a water distribution system

Definition: Process should include the following:

- describe installation procedures for hard-drawn copper, CPVC (chlorinated polyvinyl chloride), and PEX (cross-linked polyethylene) components in a water distribution system
- install water system components according to construction drawings, manufacture's specifications, and plumbing code
- lay out piping for a residential water distribution system
- rough-in water supply components for a washing machine, lavatory, kitchen sink, tank-type water closet, and a bathtub or shower

Process/Skill Questions

YY 030: Perform air-pressure & water-pressure tests

Definition: Process should include the following:

- describe procedures for an air-pressure leak test of a piping assembly
- describe procedures for a water-pressure leak test of a piping assembly
- perform an air-pressure leak test on a piping assembly according to industry guidelines
- perform a water-pressure leak test on a piping assembly according to industry guidelines

Process/Skill Questions

YY 040: Insulate water supply lines

Definition: Process should include the following:

- identify various insulating materials designed for water supply lines
- describe procedures for installing various insulating materials on water supply lines
- discuss advantages and disadvantages of pipe insulating materials
- insulate water supply lines according to plumbing code and industry guidelines

Process/Skill Questions

YY 050: Install nail guard protection for piping

Definition: Process should include the following:

- identify locations where nail guards should be installed for plumbing protection
- identify size requirements for various nail guard installations
- install nail guards in accordance with plumbing code and industry guidelines

Process/Skill Questions

**DUTY ZZ:
Installing Plumbing Fixtures and Equipment****Task:****ZZ 010: Install and trim out a lavatory**

Definition: Process should include the following:

- describe procedures for installing a wall-hung lavatory
- describe procedures for installing a countertop lavatory
- install a lavatory fixture and faucet according to plumbing code and manufacturer's specifications
- verify a lavatory installation is secure, level, and plumb
- install water supply to lavatory and check for leaks

Process/Skill Questions

ZZ 020: Install and trim out a kitchen sink

Definition: Process should include the following:

- describe procedures for installing a double kitchen sink
- measure and verify the cut-out for a sink is correct for size of sink unit
- install kitchen sink fixture and kitchen faucet according to manufacturer's specifications
- demonstrate procedure to verify sink is level
- verify solid fit and appropriate seal at rim and counter top

Process/Skill Questions

ZZ 030: Install and trim out a water closet

Definition: Process should include the following:

- describe procedures for installing a water closet
- install water closet fixture according to plumbing code and manufacturer's specifications
- install water control mechanisms for a water closet according to plumbing code and manufacturer's specifications
- verify installation is secure, level, and plumb
- verify water closet wax ring has been installed correctly
- install water supply to water closet and check for leaks

Process/Skill Questions

ZZ 040: Install a garbage disposer

Definition: Process should include the following:

- describe installation procedures for a garbage disposer in a kitchen sink
- install a garbage disposer and check for leaks according to manufacturer's specifications

Process/Skill Questions

ZZ 050: Install an automatic dishwasher

Definition: Process should include the following:

- set dishwasher in cabinet space, plumb and trim, and verify attachment of dishwasher to cabinet according to manufacturer's guidelines
- install dishwasher drain according to installation instructions and plumbing code
- install water supply to dishwasher according to installation instructions and plumbing code
- check cabinet installation, water supply, and drain for leaks

Process/Skill Questions

ZZ 060: Install a water heater

Definition: Process should include the following:

- discuss code considerations for installation of an electric water heater
- discuss code considerations for installation of a natural gas water heater
- describe installation procedures for an electric water heater
- describe installation procedures for a natural gas water heater
- install an electric or gas water heater according to manufacturer's instructions
- check installation for leaks and appropriate water supply

Process/Skill Questions

ZZ 070: Trim out a tub and shower valve

Definition: Process should include the following:

- describe the installation of a tub and shower valve
- install a tub and shower valve according to manufacturer's specifications
- verify valve installation is straight, neat, and to manufacturer's specifications
- check installation for leaks and appropriate water supply

Process/Skill Questions

ZZ 080: Install an outside water faucet

Definition: Process should include the following:

- install an outside water faucet to manufacturer's specifications and plumbing code
- check installation for leaks and appropriate water supply

Process/Skill Questions

DUTY AAA:**Service and Repair Plumbing Fixtures and Equipment****Task:****AAA 010: Replace and adjust water control mechanisms for a water closet**

Definition: Process should include the following:

- describe procedures to replace water control mechanisms in a water closet
- replace a water control mechanisms according to manufacture's directions
- adjust water control mechanisms according to manufacture's recommendations
- check installation for leaks and verify proper function of water control mechanisms

Process/Skill Questions

AAA 020: Replace a water closet flush valve

Definition: Process should include the following:

- describe procedures to remove and install a water closet flush valve
- remove and install a water closet flush valve according to manufactures guidelines
- replace a water closet tank gasket
- check installation for leaks and appropriate water supply

Process/Skill Questions

AAA 030: Troubleshoot and repair or replace automatic flushing devices

Definition: Process should include the following:

- verify correct operation of an automatic flushing device
- service automatic flushing devices according to manufacturer's maintenance manual
- install an automatic flushing device in an existing fixture

Process/Skill Questions

AAA 040: Operate a plumbing drain auger

Definition: Process should include the following:

- describe procedures for operating a plumbing drain auger
- set up an auger to clean out a drain
- demonstrate the use of an auger to clean a drain in accordance with industry guidelines

Process/Skill Questions

AAA 050: Remove and Replace a fixture trap

Definition: Process should include the following:

- describe the procedure for removing and replacing a plumbing fixture trap
- remove and replace a plumbing fixture trap
- set trap level with respect to seal
- check installation for leaks

Process/Skill Questions

AAA 060: Repair or replace a washer-type faucet

Definition: Process should include the following:

- describe the procedure for removing and replacing a washer in a washer-type faucet in accordance with manufacturer's guidelines
- remove and replace a washer in a washer-type faucet
- replace a washer-type faucet
- check installation for leaks and appropriate water supply

Process/Skill Questions

AAA 070: Repair/replace washerless faucets

Definition: Process should include the following:

- describe the procedure for removing and replacing a washerless faucet.(e.g., ball type, cartridge type, or ceramic disk type) in accordance with manufacturer's guidelines
- remove and replace a ball, cartridge, or disk in a washerless faucet
- remove and replace a washerless faucet
- check installation for leaks and appropriate water supply

Process/Skill Questions

AAA 080: Repair or replace shower diverter valve

Definition: Process should include the following:

- describe the procedure for removing and replacing a shower diverter valve
- remove and replace a shower diverter valve in accordance with manufacturer's guidelines
- check installation for leaks and appropriate water supply

Process/Skill Questions

AAA 090: Replace a bathtub waste and overflow pipe

Definition: Process should include the following:

- describe the procedure for removing and replacing a bathtub waste and overflow pipe
- replace a bathtub waste and overflow pipe according to manufacturer's guidelines
- check installation for leaks

Process/Skill Questions

AAA 100: Replace a bathtub shower arm and shower head

Definition: Process should include the following:

- replace a bathtub shower arm and shower head in accordance with manufacturer's guidelines
- check installation for leaks and appropriate water supply

Process/Skill Questions

AAA 110: Troubleshoot and replace garbage disposer

Definition: Process should include the following:

- troubleshoot a garbage disposer using procedures outlined in service manual
- describe causes for failure of garbage disposers
- describe the procedure for removing and replacing a garbage disposer
- remove and replace garbage disposer according to manufacturer's service manual

Process/Skill Questions

AAA 120: Troubleshoot and repair/replace a gas or electric water heater

Definition: Process should include the following:

- describe causes for failure of electric water heaters
- describe causes for failure of gas water heaters
- troubleshoot water heater malfunctions using procedures outlined in service manual
- describe the procedure for removing and replacing a gas water heater
- describe the procedure for removing and replacing an electric water heater
- remove and replace gas or electric water heater according to manufacturer's guidelines

Process/Skill Questions

AAA 130: Thawing frozen water pipes

Definition: Process should include the following:

- describe safe procedures for thawing frozen water pipes according to industry guidelines
- identify cautions to take when thawing frozen pipes
- demonstrate safe procedures for thawing frozen water pipes

Process/Skill Questions

AAA 140: Install plumbing repair coupling

Definition: Process should include the following:

- describe situations where plumbing repair couplings may be used
- describe the installation of a plumbing repair coupling
- describe the installation of a plumbing repair coupling following manufacturer's guidelines
- check installation for leaks

Process/Skill Questions

General Safety

DUTY : GS (General Safety) **General Safety Practices**

Task:

GS001: Follow personal safety guidelines

Definition: Process should include the following:

- identify and comply with personal safety guidelines
- demonstrate understanding of clothing safety guidelines and regulations (hard hat, hard-soled shoes, eye protection, long trousers, shirt with sleeves)
- describe the impact of positive and negative behavior on personal safety
- identify hazards of wearing jewelry while working with tools and equipment

Process/Skill Questions:

- What is the purpose for features of various safety clothing and other safety items?
- What are the steps to identify, report, and correct an unsafe working condition?
- What hazards exist for persons wearing jewelry while working in the laboratory?

GS002: Utilize tools and equipment safely

Definition: Process should include the following:

- identify and use safe working practices for common hand tools found in the industry
- identify and use safe working practices for equipment and power tools found in the industry
- explain and demonstrate safe working practices related to electrical hazards, including lockout/tagout procedures for inoperable tools and equipment
- inspect hand and power tools to ensure proper working condition
- clean and store tools in an organized manner
- demonstrate safe use of ladders
- describe the use of fall-arrest systems

Process/Skill Questions:

- What injuries may occur if a tool is used improperly?
- What items or conditions should be checked to insure that a ladder is setup properly?
- What conditions will cause a tool or piece of equipment to be unsafe?

GS003: Comply with fire and hazardous material guidelines

Definition: Process should include the following:

- identify fire hazards and methods for fire prevention
- identify procedures for fire reporting
- describe methods to extinguish fires
- identify appropriate handling for hazardous material information
- describe appropriate techniques for handling and/or disposing hazardous materials
- demonstrate appropriate measures when handling hazardous materials.
- describe information contained on Material Safety Data Sheets (MSDS)
- Locate and interpret Material Safety Data Sheets

Process/Skill Questions:

- What is the procedure for obtaining information for handling a hazardous material?
- Outline the steps to report a fire within the laboratory area.

GS004: Report injuries

Definition: Process should include the following:

- describe immediate oral reporting of injury to supervisor
- describe procedures to report accident/injury to students or instructor
- describe procedure for a written report of injury, including date, extent of injury, and circumstances

Process/Skill Questions

- What are the necessary steps to report an accident or injury?
- Who should be contacted first in the case of an accident?

GS005: Inspect work place for safe working environment

Definition: Process should include the following:

- inspect ladders, scaffolding, etc. for unstable or improperly erected condition
- identify location of electrocution hazards in the workplace
- describe procedures for removal of job/worksites debris
- describe conditions for properly storing materials
- identify methods to correct hazardous condition
- describe proper methods of storing materials
- identify air quality hazards

Process/Skill Questions

- What conditions cause a ladder to be unsafe?
- What hazards can be caused by worksite debris?

GS006: Report unsafe personal, environmental, and equipment safety hazards

Definition: Process should include the following:

- provide oral safety statements based on observation
- document hazards including date, time, location, and persons involved
- submit written safety report to supervisor

Process/Skill Questions

- What is the procedure for oral reporting of a hazardous condition?
- What type Hazards are possible in the laboratory area?

GS007: Participate in safety training programs

Definition: Process should include the following:

- participate in safety training sessions
- demonstrate knowledge and skills gained from program topics

Process/Skill Questions

- What safety equipment and materials are located in the laboratory area?
- What safety information will help you the most in avoiding injury in the laboratory area?

GS008: Practice safe lifting and carrying procedures

Definition: Process should include the following:

- describe safe lifting and carrying procedures
- identify possible injury resulting from improper lifting and carrying techniques
- demonstrate safe lifting and carrying techniques

Process/Skill Questions

- What injuries are most likely to occur from improper lifting of a heavy object?
- What weight is considered the heaviest that should be lifted with the arms and legs?

SkillsUSA

Task Definitions

DUTY A: Self - Improvement
Task:
A001: Complete a self-assessment and identify individual learning styles <i>Definition:</i> Process should include the following: <ul style="list-style-type: none"> • Identify and list individual strengths. • Identify and list areas in need of improvement. Process/Skill Questions
A002: Discover self-motivation techniques and establish short-term goals <i>Definition:</i> Process should include the following: <ul style="list-style-type: none"> • Develop a list of short-term goals. • Discuss ways to change or improve lifestyle appearance and behavior. Process/Skill Questions
A003: Determine individual time-management skills <i>Definition:</i> Process should include the following: <ul style="list-style-type: none"> • Prepare and keep a time journal. • Discuss ways to improve time management skills. Process/Skill Questions
A004: Define future occupations <i>Definition:</i> Process should include the following: <ul style="list-style-type: none"> • Search internet for career opportunities within specified fields of study. • Prepare presentation on a specified career area. Process/Skill Questions
A005: Develop awareness of cultural diversity and equity issues <i>Definition:</i> Process should include the following: <ul style="list-style-type: none"> • Research a tradition modeled by individual's family. • Develop personal philosophy statements regarding gender equity. Process/Skill Questions

<p>A006: Define the customer</p> <p><i>Definition:</i> Process should include the following:</p> <ul style="list-style-type: none"> • Differentiate between External and Internal customers • Discuss factors which contribute to poor customer relationships. <p>Process/Skill Questions</p>
<p>A007: Recognize benefits of doing a community service project</p> <p><i>Definition:</i> Process should include the following:</p> <ul style="list-style-type: none"> • Discuss and list ways to become involved in the community • Develop a community service project. <p>Process/Skill Questions</p>
<p>A008: Demonstrate effective communication with others</p> <p><i>Definition:</i> Process should include the following:</p> <ul style="list-style-type: none"> • Identify and list personal barriers to listening. • Develop personal plan to overcome barriers to listening. <p>Process/Skill Questions</p>
<p>A009: Participate in a shadowing activity</p> <p><i>Definition:</i> Process should include the following:</p> <ul style="list-style-type: none"> • Summarize experience of job shadowing activity. <p>Process/Skill Questions</p>
<p>A010: Identify the components of an employment portfolio</p> <p><i>Definition:</i> Process should include the following:</p> <ul style="list-style-type: none"> • Identify parts of a portfolio • Design a personal employment portfolio <p>Process/Skill Questions</p>
<p>A011: List proficiency in program competencies</p> <p><i>Definition:</i> Process should include the following:</p> <ul style="list-style-type: none"> • Complete an interpersonal competency assessment. <p>Process/Skill Questions</p>
<p>DUTY B: Civic, Social and Business Awareness</p>
<p>Task:</p>

<p>B001: Measure/modify short-term goals</p> <p><i>Definition:</i> Process should include the following:</p> <ul style="list-style-type: none"> • Discuss steps to pursue short-term goal(s) <p>Process/Skill Questions</p>
<p>B002: Identify stress sources</p> <p><i>Definition:</i> Process should include the following:</p> <ul style="list-style-type: none"> • List personal sources of stress. • Discuss techniques to cope with individual sources of stress. <p>Process/Skill Questions</p>
<p>B003: Select characteristics of a positive image</p> <p><i>Definition:</i> Process should include the following:</p> <ul style="list-style-type: none"> • Discuss actions and traits that lead to a positive image. • Discuss actions and traits that lead to a negative image. <p>Process/Skill Questions</p>
<p>B004: Demonstrate awareness of government, professional organizations and trade unions</p> <p><i>Definition:</i> Process should include the following:</p> <ul style="list-style-type: none"> • Identify state governor, legislators, and senators. • Identify professional organizations pertaining to specific career areas. <p>Process/Skill Questions</p>
<p>B005: Apply team skills to a group project</p> <p><i>Definition:</i> Process should include the following:</p> <ul style="list-style-type: none"> • Form a team to develop a class project. <p>Process/Skill Questions</p>
<p>B006: Observe and critique a meeting</p> <p><i>Definition:</i> Process should include the following:</p> <ul style="list-style-type: none"> • Attend a formal meeting held within the community • Critique the attended meeting. <p>Process/Skill Questions</p>
<p>B007: Demonstrate business meeting skills</p> <p><i>Definition:</i> Process should include the following:</p> <ul style="list-style-type: none"> • List and discuss the basic rules to ensure an orderly and business-like meeting

<ul style="list-style-type: none"> • Role-play appropriate meeting skills <p>Process/Skill Questions</p>
<p>B008: Demonstrate social etiquette</p> <p><i>Definition:</i> Process should include the following:</p> <ul style="list-style-type: none"> • Role-play appropriate social behavior • Differentiate between good and bad manners. <p>Process/Skill Questions</p>
<p>B009: Complete survey for employment opportunities</p> <p><i>Definition:</i> Process should include the following:</p> <ul style="list-style-type: none"> • Gather information on a particular employment opportunity of interest. • Conduct internet search of a specific career area. <p>Process/Skill Questions</p>
<p>B010: Review a professional journal and develop a 3 to 5 minute presentation</p> <p><i>Definition:</i> Process should include the following:</p> <ul style="list-style-type: none"> • Develop a presentation on the content, purpose, and distribution of a particular professional journal <p>Process/Skill Questions</p>
<p>B011: Identify customer expectations</p> <p><i>Definition:</i> Process should include the following:</p> <ul style="list-style-type: none"> • List and discuss customer expectations. • Discuss consequences of unmet customer expectations. <p>Process/Skill Questions</p>
<p>B012: Complete a job application</p> <p><i>Definition:</i> Process should include the following:</p> <ul style="list-style-type: none"> • Obtain a job application from various businesses in the community • Conduct a mock job interview. <p>Process/Skill Questions</p>
<p>B013: Identify a mentor</p> <p><i>Definition:</i> Process should include the following:</p> <ul style="list-style-type: none"> • Define mentor. • Discuss ways in which a mentor can help an individual meet career goals.

Process/Skill Questions
<p>B014: Assemble your employment portfolio</p> <p><i>Definition:</i> Process should include the following:</p> <ul style="list-style-type: none"> • Develop employment portfolio <p>Process/Skill Questions</p>
<p>B015: Explore supervisory and management roles in an organization</p> <p><i>Definition:</i> Process should include the following:</p> <ul style="list-style-type: none"> • Examine an organizational chart • Discuss responsibilities of managers and supervisors <p>Process/Skill Questions</p>
<p>B016: Recognize safety issues</p> <p><i>Definition:</i> Process should include the following:</p> <ul style="list-style-type: none"> • Discuss safety issues within a given career area <p>Process/Skill Questions</p>
<p>B017: Evaluate your proficiency in program competencies</p> <p><i>Definition:</i> Process should include the following:</p> <ul style="list-style-type: none"> • Define task and competency • List competencies associated with a specified career area. <p>Process/Skill Questions</p>

Technical And Professional Curriculum Frameworks

Purpose

This section of the framework contains material to help instructors in technical and professional programs to reinforce basic skills in the areas of Reading and Writing, Math and Science. The technical portion of this guide takes a more direct approach by using specific duty and task listings, but changes in the academic section lead in a more general direction. The reason for this is simple: all good instructors do not teach in the same way. However, all good instructors share the trait of being able to connect their material to everyday life. For example, understanding concepts related to heat, are important for cosmetology students as well as lathe operators in manufacturing plants. However, each program will probably take a different approach in the amount of detail and examples relating to heat concepts. Both groups require basic science knowledge of principles relating to heat, but the application of the principles will be different.

Basic Skills: The Content Areas

Included in this guide are materials to support basic skills in Reading and Writing, Mathematics, and Science. The overall approach taken here is a move toward problem-solving skills. By problem-solving, we mean the ability to take information and use it for a purpose: to take action, make decisions, predict outcomes, suggest improvements. Another term for these thinking skills is a general “literacy.”

Literacy skills have always been in demand in the workplace. A quick review of workplace training programs and other literature regarding adult education demonstrates that the need for a literate workforce is still one of the most pressing problems employers face today. Indeed, many employers (from small- and medium-sized businesses to Fortune 500 companies) have spent hundreds of millions of dollars on in-house basic skills training programs.

What constitutes a literate workforce? There are many definitions for literacy and hundreds of tests that measure it, but when employers are asked what they're looking for in potential new hires, the answers are general: they want individuals who can read and write; show up on time; think and solve problems, and keep their personal lives in order (that is, don't bring a drinking problem into the workplace).

Viewed in this way, the words "literacy" and "literate" are good terms for what educators are trying to instill in their students, the future workforce. The more common definition (being able to read and write) is certainly appropriate but the additional definitions (knowledgeable, educated, well-informed) are also apt. It is this broad term, "literate," that we use to guide instructors on what to cover in the classroom. No matter which career and technical area is being focused on, no matter how technical the terminology is, instructors are given the task of helping students take information, break it down into necessary parts, process details, and be able to come away with an understanding of some sort. This is "literacy", and the process is the same for every subject area-- teaching students how to think and solve problems.

Format

Each section includes a two-column table. Skills are listed on the left side; suggestions for implementing these skills into the curriculum are listed on the right side. Each suggestion is written in such a way that it can be tailored to most career and technical programs.

Using The Guide

This guide was prepared with four concepts in mind:

- The instructor is *aware of the need* for students to improve their basic skills.
- The instructor is the *best-qualified person* to decide how to include this material in the classroom or lab. The students' abilities and needs should drive the instructor in deciding how to use, expand, or modify these topics.
- The instructor *already has curriculum that works* for his or her students. Therefore, the suggestions for reinforcing basic skills
 - must be easy to implement

- must stand alone
 - do not need to be taught in a particular order
 - must be open-ended enough to be useful for any career/technical program.
- ***Time is limited.*** Unless there are quick ways to reinforce basic skills, changes to the curriculum will not be made. Teaching basic skills in the context of technical material will help students make connections that are more memorable, and will require no additional lesson planning. Just as instructors incorporate updates in technical knowledge, they can add basic skills concepts as well. Adding a few concepts at a time will help students perform better in the lab as well as on tests and evaluations.

Methods

The following methods may help instructors decide how to increase basic skill knowledge:

- *Collaborative projects*- how could a joint project between regular education teachers and career instructors reinforce concepts for both programs?
- *Outside assignments*- would students benefit from an outside assignment explaining how a basic math (science, reading) concept ties to a process in the lab?
- *Extra credit*- students needing extra credit can research outside topics and turn in a short summary of material
- *“Need-to-know” assignments*- Students prepare a bulleted list of the basic concepts in science they need to know in order to correctly perform ____ operation in the lab.
- *Question of the Day*- a few daily math problems for students to answer at the beginning of class allows the instructor to set the tone for the material. It also gives students an immediate goal when they enter the classroom and teaches them to stay on task. Bonus points may be awarded at the end of the week, quarter, semester, etc.
- *Two-minute Oral Presentations*- students who need to practice speaking skills can be asked to give a two-minute oral presentation at the end of class summarizing the main points for the day. Or, a two-minute presentation at the beginning of class can recap the material from a previous class.

- *Connecting with Workers*- students can poll parents, friends, area employers or other persons to find out the top 5 basic science skills needed on the job.
- *Direct Questioning*- include a few basic knowledge questions in a presentation. Award points to groups based on correct answers.

Resources

In creating the Academic Reinforcement material for the technical and professional frameworks, we used a number of source documents and resources.

- The English Language Arts, Science, and Mathematics components of the *Curriculum Improvement Project* by Dr. Willard Daggett were consulted to ensure that the top-ranked skills in those areas would be reflected in the academic support material. The English Language Arts and Science components have many linkages to the material included here. (The higher-level math skills such as trigonometry were not included in this document.)
- Data from work with Arkansas employers- the Workplace Skills Enhancement Program (WSEP) at the University of Arkansas at Little Rock (UALR) has completed many training projects and job profiles for employers in Arkansas. Our constant contact with workers and employers provides a tremendous amount of data that we use in designing customized training programs and in working on projects such as curriculum frameworks. Also, the staff of WSEP has experience teaching in Arkansas public schools, the US military, and the Job Corps.
- Additionally, other groups within UALR (the Labor Education Program, the Institute for Economic Advancement and the College of Business) provide resources regarding health and safety information, labor unions and their role in the workplace, computer and information technology and other training and outreach program data.
- US Department of Labor- the US DOL has many online documents and publications that support workers and issues regarding the workplace. (Work by Philippi and Greenan, 1988 on workplace skills was especially helpful.) Visit the website at www.dol.gov.

- Occupational Safety and Health Administration (OSHA) provides online and other resources for instructors and professionals. For topics relating to safety and health, visit www.osha.gov.
- Multistate Academic and Vocational Curriculum Consortium (MAVCC) is an organization that develops competency-based curriculum. For more on MAVCC see www.mavcc.org.

ACADEMIC STANDARDS FOR READING AND WRITING

Strategies for Reinforcement in the Career and Technical Classroom

Note:

* indicates industry-related materials, handouts, notes, etc.

Objective	Classroom Applications to Industry
<p><i>Present,</i> <i>Review and Discuss,</i> <i>Master</i> the list of skills employers want for the workplace regarding reading and writing.</p>	<p>Use the list of skills employers want to introduce students to the requirements of the workplace.</p> <p>Depending on students' ability levels, any of the following methods may be used to increase their understanding of the concepts:</p> <ul style="list-style-type: none"> • Discussion • Interviewing parents or other adults in the workplace about the skills required • Interviewing employers about the skills in terms of importance • Identifying workplace situations in which certain skills become more important than others • Researching adult education programs to learn why deficits in these areas must be remediated, and the cost spent yearly on these programs • Researching the topic of adult literacy
<p><i>Answer</i> simple comprehension or recall questions from a lecture or from written material.</p>	<p>Provide 2 examples of workplace materials* on students' reading level.</p> <p>With the first, allow students to read information and then answer brief recall questions.</p> <p>With the second example, read aloud the material but do not give a handout. Ask brief recall questions.</p> <p>Compare the differences...how do students retain information better—orally or visually? Discuss learning styles and impact on the job.</p>
<p><i>Follow,</i></p>	<p>Using instructions for a hands-on task, have</p>

<i>Give oral instructions.</i>	students give <u>oral</u> instructions to a partner or group. Rate the effectiveness of the speaker.
<i>Follow,</i> <i>Give written instructions.</i>	Using a short list of instructions for a hands-on task, have students give <u>written</u> instructions to a partner or group. Rate the effectiveness of the speaker.
<i>Show the difference between relevant and irrelevant details.</i>	Using a copy of workplace materials*, students underline relevant or important details in red, irrelevant or less important details in blue.
<i>Sort objects based on x number of criteria.</i>	Using workplace materials*, sort a group of objects based on characteristics identified by instructor (e.g., by color, shape, defect, or a combination of these).
<i>Recognize,</i> <i>Identify technical vocabulary.</i>	Using workplace materials*, highlight technical vocabulary terms. Create a class dictionary of industry-related technical vocabulary. Students may add illustrations or diagrams. Each student receives a copy of the final product. Emphasize skills such as alphabetical order, guidewords, prefixes, suffixes, and pronunciation guides.
<i>Read aloud.</i>	Read aloud from workplace materials* in groups or individually.
<i>Identify,</i> <i>Explain symbols, abbreviations and acronyms relevant to subject area.</i>	Using workplace materials*, highlight symbols, abbreviations, and acronyms. Create a table with one column for each of symbols, abbreviations, acronyms. Classify each one and write in the meaning.
Understand, <i>Use rules of grammar, usage, spelling, punctuation.</i>	Identify the missing punctuation mark, misspelled word, incorrect use of grammar from workplace materials*. Correct the mistakes.
<i>Discuss <u>uses and purposes</u> of a variety of workplace communication tools.</i>	Find examples of a business letter, memo, report, brochure, proposal, schematic, map, and

	diagram.
<i>Duplicate</i> process demo by instructor	Using a workplace process, demonstrate steps to complete and have students perform individually or in groups.
<i>Notice,</i> <i>Apply</i> word analysis techniques.	Using workplace materials*, identify prefixes, suffixes, or roots that indicate meaning (e.g. therma = heat) ¹
<i>Match</i> parts from photographs or diagrams to actual objects.	Using workplace materials*, follow a sequence of pictures or diagrams to build, create, or copy an item or process.
<i>Read</i> for main ideas and for details.	Use a graphic organizer ¹ to show main ideas and supporting details.
<i>Distinguish</i> between fact, opinion, and inference.	Collect examples of materials based on fact or opinion/inference. Ask students to underline key terms that indicate the presence of facts or opinions.
<i>Distinguish</i> between rows and columns; identify a cell as a block where a row and column intersect.	Using charts or tables from workplace materials*, discuss the reasons for this format. Identify the quantity in a particular cell.
<i>Select,</i> <i>Use</i> appropriate resources and reference tools.	Explain the uses for the following: Dictionary, Thesaurus, Almanac, Atlas, Card Catalog, Encyclopedia. List reasons for choosing one reference tool over another. Use reference tools to answer questions related to industry or current events.
<i>Paraphrase</i> written or oral material into summary form.	Using workplace materials*, determine the best way to condense or shorten the material so as to give an overview to a layperson. Using a set of guidelines appropriate to students' level in length and detail, summarize the information into bullet points.

<p><i>Interpret,</i> <i>Fill out/complete forms and records.</i></p>	<p>Using workplace materials*, answer basic questions (e.g., summarize the list of parts from an inventory).</p> <p>Using blank forms or documents, fill in details. Pay close attention to directions. Students critique work with partner.</p> <p>Create a form or document to be used in a workplace process.</p>
<p><i>Use,</i> <i>Develop a process for remembering details.</i></p>	<p>Use pneumatic devices to organize and remember details. Pneumatic devices¹ include Semantic Maps, Thought Webs, and other creative tools to organize thinking.</p>
<p><i>Proofread,</i> <i>Correct mistakes in written drafts.</i></p>	<p>Using a newspaper article, locate and mark mistakes in grammar, punctuation, or usage.</p> <p>Correct mistakes in written drafts.</p>
<p><i>Examine different types of writing used in the workplace (reports, memos, brochures, logs, blueprints, formulas, etc).</i></p>	<p>Gather samples of workplace materials*. Identify each by type.</p> <p>Compare and contrast the difference between audience, (who the document is written for) length, background information/education needed to understand material, level of detail, organization and layout of the document.</p>
<p><i>Understand the writing process.</i></p>	<p>In order to apply the writing process, create a workplace communication tool to be used for a specific purpose.</p> <p>Prewrite: Brainstorm, gather facts, or do research to create a <u>business letter, memo, report, brochure, proposal, schematic, map, or diagram.</u></p> <p>Identify the audience.</p>

	<p>Determine the purpose of the document.</p> <p>Write: Create a first draft.</p> <p>Revise and Edit: Make changes to ensure accuracy.</p> <p>Look at the writing from a different point of view.</p> <p>Shorten or make more concise where possible.</p> <p>Use white space, bold print and other formatting details to make the document easy-to-read.</p> <p>Publish: Decide on the best format for the final copy (size, type of material, layout, graphics, etc.)</p> <p>Publish the final draft.</p>
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<p><i>Identify,</i> Create sentences of different types.</p>	<p>Using workplace materials*, find sentences of varying types. Examples include Simple Sentences (subject + predicate) Complex Sentences (subject + predicate including clauses).</p> <p>Write sentences, paragraphs, or essays using sentences of different types (e.g., write a 2-paragraph summary of today's lesson).</p>
<p><i>Identify,</i> Use contractions correctly.</p>	<p>Using workplace materials*, locate contractions (e.g., isn't, I'll).</p> <p>Identify misuses of contractions.</p> <p>Write a short list of directions relating to an industry process and use as many contractions as possible.</p>
<p><i>Identify,</i> Use correctly commonly misspelled words.</p>	<p>Using a list of commonly misspelled words¹, locate errors in the media (newspaper articles, Internet sites, magazines.)</p> <p>Ask each student to identify his problem words from the list.</p> <p>Attempt to incorporate problem words into class activities (e.g., add them to a list of work instructions).</p> <p>Give short weekly quizzes focusing on 5 words per week. Award bonus points.</p>
<p><i>Identify,</i> Use correctly the English irregular verbs.</p>	<p>From a list of irregular verbs, review the uses of each.</p> <p>Ask each student to identify his problem irregular verbs from the list.</p> <p>Attempt to incorporate problem verbs into class activities, such as making a collection of mistakes from print.</p>
<p><i>Identify,</i> Use Signal Words and other cues to improve</p>	<p>Use a list of Signal Words¹ and discuss their purpose in writing (signal words are words that</p>

writing.	<p>raise a flag to a reader to pay attention.) Examples: Signal Words showing emphasis: Most of all, It should be noted, Of course</p> <p>Signal Words showing a conclusion: Lastly, In summary, Finally</p> <p>Identify common signal words in workplace writing, especially in sequenced lists.</p> <p>Write a list of work instructions using signal words.</p>
<i>Identify components of workplace documents such as blueprints, schematics, floor plans, and other industry-related documents.</i>	Label the parts of a workplace document.
<i>Place steps in proper sequence.</i>	Using a list of steps or pictures cut them apart so that students can place them in the proper order.
<i>Analyze cause and effect.</i>	Experiment with cause and effect in the classroom (e.g., change the sequence of events in a process).
<i>Determine missing information.</i>	<p>Locate the information that is missing from a problem and explain why the problem cannot be solved without it.</p> <p>To reinforce concepts, use a completed problem and remove the important details. Ask students if they can identify what's missing.</p>
<i>Differentiate between tools used for a job.</i>	Given a list of tools and a list of functions, identify the most efficient tool for each task.
<i>Assemble or disassemble objects.</i>	<p>From a list of oral or written instructions, assemble an object or complete a process.</p> <p>Students write the instructions for disassembly.</p>

<i>Cross-reference materials to compare information.</i>	Using more than one source document, compare the information given.
<i>Interpret reasoning behind rules or regulations.</i>	Using workplace materials*, make a list of possible reasons or justifications for a safety guideline, regulation, etc.
<i>Show contrasts between approaches.</i>	<p>Given a workplace scenario, write a brief approach to solving the problem. (Working in groups would be beneficial.)</p> <p>Compare and contrast each approach from the perspective of a worker, manager, supervisor.</p>
<i>Organize data in a new format.</i>	Using workplace materials*, organize the information into a new format.
<i>Prove a rule or method's sufficiency.</i>	Perform an experiment to determine how much tolerance is acceptable in a case study, (e.g., find the range of drops of red dye sufficient to match the standard red color used in latex paint).
<i>Show relationships between two or more systems.</i>	Using 2 or more partners related to industry, show or explain how they are interrelated (e.g., explain the relationship between social workers and hospitals).
Given examples of emergency situations, identify real world course of action.	Using an emergency situation common to your industry, outline a step-by-step plan for action.
<i>Identify variables that affect the outcome of a process.</i>	Experiment with or predict variables that affect the outcomes for a process (e.g., weather patterns that adversely affect a process, such as building a road).
<i>Infer situations that meet guidelines when complete information is not available.</i>	<p>Given a policy or industry standard that has debatable interpretations, list possible situations that can arise that do not have clear solutions in the policy.</p> <p>Discuss or debate the issues.</p>
<i>Compare finished products to a set of</i>	Compare a set of objects to a set of guidelines

guidelines.	<p>(e.g., analyze a batch of parts and document how they do or do not meet a set of Quality Assurance guidelines).</p> <p>List any discrepancies (parts that do not meet guidelines) and categorize them by type (e.g., burns, holes, etc).</p>
<i>Identify preventative measures for maintenance of a system.</i>	List the needed routine maintenance to keep a system working properly.
<i>Predict new standards or rules that may become necessary in the future.</i>	<p>Identify recent areas of change or development in your industry.</p> <p>Discuss potential future needs or developments that may occur (e.g., potential need for better training requirements for airport personnel).</p>
<i>Improve a process by streamlining (locating waste) or decreasing lost time.</i>	<p>Examine a process in industry in step-by-step detail. Suggest ways to decrease time needed or make the process more efficient.</p> <p>Isolate the cause of failure in a process by performing an experiment.</p>
<i>Prepare a model explaining a concept.</i>	Build, draw, or create a model that explains a concept (e.g., show a need for environmental standards for water or air pollution).

¹ Fry, Edward; Kress, Jacqueline; Fountoukidis, Dona. *Reading Teacher's Book of Lists*, 4th ed. ISBN 0-13-028185-9.

ACADEMIC STANDARDS FOR MATHEMATICS

Strategies for Reinforcement in the Career and Technical Classroom

Note:

* indicates industry-related materials, handouts, notes, etc.

Topics Listing

Problem Solving

Operations and Calculations

Applications

Data Analysis and Display

Objectives	Classroom Applications to Industry
<p><i>Present</i> <i>Review and Discuss</i> Master the list of skills employers want for the workplace regarding mathematics.</p>	<p>Use the list of skills employers want to introduce students to the requirements of the workplace.</p> <p>Depending on students' ability levels, any of the following methods may be used to increase their understanding of the concepts:</p> <ul style="list-style-type: none"> • Discussion • Interviewing parents or other adults in the workplace about the skills required • Interviewing employers about the skills in terms of importance • Identifying workplace situations in which certain skills become more important than others • Researching adult education programs to learn why deficits in these areas must be remediated, and the cost spent yearly on these programs • Researching the topic of adult literacy
PROBLEM SOLVING	
<p><i>Examine</i> Apply problem-solving process.</p>	<p>Define the problem What is being asked? Decide on a type of solution Multi-step or single-step question? Try any of these: Estimate an answer Draw a diagram</p>

	<p>Find a pattern Guess and check Logical Reasoning Make a graph Make an organized list Make a table Solve a simpler problem Use a simulation Work backwards Write an equation</p> <p>Locate information you need Do you have all the components?</p> <p>Get missing information May need to perform some other calculations</p> <p>Calculate Look at the answer. How should the remainder be expressed?</p> <p>Check the solution Is it reasonable?</p>
OPERATIONS AND CALCULATIONS	
<i>Read, write, and count numbers.</i>	<p>Read and write numbers (especially focus on very large and very small numbers where mistakes are common).</p> <p>Give a weekly quiz asking students to compare and sequence numbers. Example: 0.4445 ____ 0.4455 > or <</p> <p>Put these in order from smallest to largest: 0.66, 0.677, 0.67</p>
<i>Round numbers.</i>	<p>Discuss your industry's use of decimals.</p> <p>Identify the place values needed to adequately perform a job. For example, a Quality Assurance Technician who works on the line in a manufacturing plant may need to use numbers through the ten-thousandths decimal</p>

	<p>place.</p> <p>Take a series of sample measurements, and round them to the nearest decimal place identified by the instructor.</p>
<i>Estimate numbers.</i>	<p>The skill of making close estimations is tied to understanding accuracy.</p> <p>Discuss real-life situations where estimation is used.</p> <p>Discuss the practice of estimation before calculation. Regular practice in estimating before calculating will teach students where they make errors and will increase their estimation skills.</p> <p>Discuss work situations where estimation skills are required, and possible consequences of making estimation errors (for example, is an estimate appropriate for inventory purposes? For ordering supplies?)</p>
<i>Compute averages.</i>	<p>Discuss averages in general terms. Calculate the average temperature, average rainfall or precipitation, average number of students per class, and other relevant examples.</p> <p>Using workplace materials*, calculate a series of averages.</p> <p>For example:</p> <ul style="list-style-type: none"> • Take 10 different measurements of a piece of pipe using a micrometer. • Compare the measurements. • Find the average of all the measurements. • Compare the average to the smallest and largest measurement. • Discuss the effects on quality...when is an average an acceptable benchmark measurement?
<i>Calculate with whole numbers: perform one-step problems with basic operations.</i>	<p>Understand, at a level of complexity appropriate to your industry and to students' ability levels, basic principles of addition,</p>

	subtraction, multiplication, and division.
<i>Perform problems that require an understanding of the order of operations.</i>	<p>Using workplace materials*, make a list of situations or problems that need more than one step to perform them.</p> <p>If the procedures (add, subtract, multiply, divide, etc) are on the same level of importance, such as adding or subtracting, then the order of operations will not impact the way the problem is solved.</p> <p>If a problem requires more than one level of operation to solve (example, dividing and adding), work the problem correctly by performing the division part first and then the addition.</p> <p>Rework the problem using addition first. Compare the answers.</p> <p>Discuss the importance of reasoning skills to verify that an answer makes sense.</p>
<i>Understand the relationship between decimals, fractions and percents.</i>	Make a table comparing fractions, decimals, and percents.
<i>Compute with fractions, decimals, and percents, and show understanding of the relationship between them.</i>	<p>Create sample problems using fractions that relate to everyday situations.</p> <ul style="list-style-type: none"> ▪ Poll the class on interesting topics (favorite food). Convert whole numbers to fractions. Votes- Pizza- 10 Salad- 2 BBQ- 8 <p>$10+2+8 = 20$ (recognize denominator value)</p> <p>$\frac{10}{20}$ Pizza $\frac{2}{20}$ Salad $\frac{8}{20}$ BBQ</p> <ul style="list-style-type: none"> ▪ Add the fractions. <p>$\frac{10}{20} + \frac{2}{20} + \frac{8}{20} = \frac{20}{20}$</p>

	<ul style="list-style-type: none"> Convert fraction to whole number. (Total answers equal 1 class's worth of answers.) $\frac{10}{20} + \frac{2}{20} + \frac{8}{20} = \frac{20}{20} = 1$ Convert fractions to percents. $\frac{10}{20}$ means 10 divided by 20 = 0.50 0.50 = 50% Move decimal 2 places right. 0.50 = 50% $\frac{2}{20}$ means 2 divided by 20 = 0.10 0.10 = 10% $\frac{8}{20}$ means 8 divided by 20 = 0.40 0.40 = 40% 50% + 10% + 40% = 100% Notice the totals add to 100%. So, $\frac{20}{20} = 1 = 100\%$ <p>Using workplace materials*, calculate work-related questions using fractions, decimals, and percents.</p> <p>Calculate shipping costs for internet purchases (such as music from amazon.com).</p>
<i>Solve formulas and equations.</i>	<p>Understand, at a level of complexity appropriate to your industry and to students' ability levels, basic principles of equations.</p> <ul style="list-style-type: none"> Work left to right Use order of operations Place numbers on one side, variables on the other side
<i>Obtain squares and square roots.</i>	<p>Review the methods for calculating squares, square roots, cubes, and cube roots. Use</p>

	<p>industry-related formulas to demonstrate examples.</p> <p>Compare the difference between the 2 common answers to 3^2 (answer = 9, not 6). How would an incorrect value affect the work on the job?</p>
<p>Convert units of measure: <i>Recognize components of measuring systems (US and metric) for length.</i></p>	Discuss industry measures and terms relating to length.
<p>Convert units of measure: <i>Recognize components of measuring systems (US and metric) for mass/weight.</i></p>	Discuss industry measures and terms relating to mass/weight.
<p>Convert units of measure: <i>Recognize components of measuring systems (US and metric) for volume.</i></p>	Discuss industry measures and terms relating to volume.
<p><i>Measure with a certain degree of accuracy.</i></p>	<p>Estimate measurements.</p> <p>Using workplace materials* and tools, take measurements of work-related and classroom items.</p> <p>Depending on ability level, students may measure to the nearest foot, inch, centimeter, etc.</p>
APPLICATIONS	
<i>Solve word problems.</i>	Help students feel more comfortable with word problems by placing simpler problems in word problem form; or take concepts students have already mastered and ask them to write word problems for each other to solve.
<i>Select/apply mathematical formula.</i>	Review a set of math formulas and then a list of sample problems. Decide which formula(s) apply to each problem.
<i>Understand the importance of time in the workplace.</i>	Using workplace materials*, make a list of workplace scenarios that require using time correctly, such as keeping a time card, or heating a liquid solution for 20 minutes.

Recognize components of time systems (clocks and calendars).	AM and PM Leap Year Military time
<i>Discuss, Identify, Understand</i> terms relating to measuring time.	Discuss the units of time measurement and time vocabulary: second, minute, hour, day, week, month, year, leap year, fiscal year, quarter, annual, biannual, etc.
Understand that time can be expressed in terms of equivalencies.	Show the time equivalencies using fractions. For example: $1 \frac{1}{2} \text{ days} = \underline{\hspace{1cm}} \text{ hours}$ $\begin{array}{rcl} 1 \text{ day} & = & 24 \text{ hours} \\ + \frac{1}{2} \text{ day} & = & +12 \text{ hours} \\ \hline 1 \frac{1}{2} \text{ days} & = & 36 \text{ hours} \end{array}$
Compute time conversions.	Make a table that shows the equivalencies of time units. Compute conversion problems at the appropriate level of difficulty. Examples include: <ul style="list-style-type: none"> • Convert minutes to hours • Convert hours to days • Convert seconds to years.
Calculate ratio and proportion.	Review fractions when discussing ratio and proportion. Draw common classroom items to scale by finding a conversion rate (1 foot equals 1 inch). Make predictions using ratios. (If each student in class has 3 children, how many children will there be all together? Write the ratios.)
Apply geometry principles: Use formulas for measuring shapes of 2 dimensions.	Determine the formulas that apply to 2 dimensions: perimeter, area, surface area, etc. Find perimeter of classroom. Discuss perimeter of objects that are not shaped as perfect squares. How does this

	<p>change the formula for perimeter?</p> <p>Find the area of the tiles on the floor. Find the area of the classroom. Review that all areas are expressed in terms of square units (square inches, square miles, etc)</p>
<i>Apply geometry principles: Use formulas for measuring shapes of 3 dimensions.</i>	<p>Review the formulas that apply to 3 dimensions of objects: volume. Find the volume of common objects such as soda cans, pizza boxes, etc. Review that volume is expressed in cubic units.</p> <p>Discuss industry-specific needs for these formulas; for example, find the volume of a tank or silo.</p>
<i>Define terms relating to money.</i>	<p>Understand, at a level of complexity appropriate to your industry and to students' ability levels, basic principles relating to money.</p> <p>For more advanced students, include terms and principles of economics, finance, or statistics.</p>
<i>Perform one-step problems involving money.</i>	<p>Make change. Count up (rather than backwards) to make change.</p>
<i>Perform multiple-step problems using money.</i>	<p>Calculate gross and net earnings.</p> <p>Calculate</p> <ul style="list-style-type: none"> ▪ Interest ▪ Sales tax ▪ Percent off ▪ Sale price ▪ Profit percentages <p>Perform banking transactions.</p>
<i>Perform business-related financial activities.</i>	<p>At a level of complexity appropriate to your industry and to students' ability levels, solve</p>

	income/expense problems, prepare budgets, etc.
<i>Use a calculator to perform computations.</i>	Identify appropriate activities that can be performed using a calculator (calculators allow students to concentrate on problem-solving strategies. Award prizes for weekly activities or competitions.
<i>Calculate measurements taken from measuring devices.</i>	Add, subtract, multiply and divide measurement numbers by plugging them into formulas.
<i>Perform/prepare an inventory.</i>	Use a sample group of items to prepare an inventory. Review inventory vocabulary terms. Discuss the math processes that would apply to the inventory process.
DATA ANALYSIS AND DISPLAY	
<i>Recognize types of visual representations.</i>	Charts Graphs Tables
<i>Interpret charts, graphs and tables.</i>	Answer simple questions about charts, graphs and tables. <i>Solve</i> multi-step problems involving the correlation of graphs and tables.
<i>Collect/record data.</i>	As appropriate to industry, practice sampling methods. Discuss safety precautions for sampling. Visit OSHA at the Department of Labor website for more details. Practice collecting and recording sample data from your industry (such as measurements taken using a micrometer). Compare class answers. Find the range of answers (maximum and

	<p>minimum). Find the average.</p> <p>Discuss an acceptable range of answers (\pm), and graph the results showing the number that fell inside and outside the acceptable range.</p>
<i>Review and apply principles of probability.</i>	<p>Use real-life examples that are highly motivating to direct the students' attention to probability principles. (Example, "I am thinking of a number between 1 and 50. The person who guesses the number will receive that many bonus points if she can tell me the probability of choosing the number correctly.")</p>
Use probability models to predict chance events.	<p>Calculate <u>theoretical probability</u> of an event (e.g., the probability of rolling a 5 on a die is $1/6$).</p> <p>Find <u>empirical probability</u> of an event by performing repeated experiments.</p> <p>Compare the 2 probabilities.</p>
<i>Calculate and interpret statistics.</i>	<p>Identify the importance of using statistics correctly. Bring examples of statistics from the news or media and analyze them: are they ambiguous? Are they correct? What data is the advertisement trying to get the public to see?</p> <p>For a humorous look at statistics, see <i>How to Lie with Statistics</i> by Huff and Geis.</p>
<i>Interpret plans/blueprints.</i>	<p>Review vocabulary and terms for plans, blueprints and schematics.</p> <p>Build a plan or blueprint one layer at a time, starting with the basic identifying information.</p> <p>Add layers of wax paper or other transparent drawing material on top of the first layer that allows each layer to be viewed individually,</p>

	or the entire drawing as a whole.
<i>Construct charts and tables.</i>	<p>Discuss chart types and chart vocabulary.</p> <p>Using workplace or sample data from the class, construct tables and charts.</p> <p>For a daily example, consult <i>USA Today</i> online and look for the snapshots section that shows a graph of some sort. Ask weekly bonus questions about the data.</p> <p>Challenge students to bring in examples of charts and graphs containing errors.</p>

ACADEMIC STANDARDS FOR SCIENCE

Strategies for Reinforcement in the Career and Technical Classroom

Note:

*** indicates industry-related materials, handouts, notes, etc.**

Topics Listing

General Science- topics not specific to a content area

Physical Science-

- Mechanics and Physics
- Energy and Waves
- Thermodynamics
- Electromagnetism
- Chemistry
- Optics

Life Science-

- Cell biology
- Evolution
- Genetics and Heredity
- Human and Animal Development

Anatomy

- Ecology
- Viruses
- Bacteria
- Plants

Earth Science-

- Earth in space
- Solar System/Astronomy
- Atmosphere and weather
- Oceans and water
- Earth resources

Note:

* indicates industry-related materials, handouts, notes, etc.

Objective	Classroom Applications to Industry
GENERAL SCIENCE	
<p><i>Present,</i> <i>Review and Discuss,</i> Master the list of skills employers want for the workplace regarding science skills.</p>	<p>Use the list of skills employers want to introduce students to the requirements of the workplace.</p> <p>Depending on students' ability levels, any of the following methods may be used to increase their understanding of the concepts:</p> <ul style="list-style-type: none"> • Discussion • Interviewing parents or other adults in the workplace about the skills required • Interviewing employers about the skills in terms of importance • Identifying workplace situations in which certain skills become more important than others • Researching adult education programs to learn why deficits in these areas must be remediated; find out the cost to employers to educate adult workers • Researching the topic of adult literacy
<p><i>Perform</i> computations as required to solve problems.</p>	<p>Use the metric system to convert units of measure.</p> <p>Round numbers to correct number of significant figures.</p> <p>Determine percentage of error.</p> <p>Understand validity, reliability, accuracy, and precision.</p>
<p><i>Apply</i> scientific method of inquiry.</p>	<p>Identify the steps of the scientific method.</p> <p>Conduct experiments.</p> <p>Understand the following terminology: Conclusions vs. inferences Variables Replications</p>

	Samples/sample size
<i>Investigate science history as it applies to industry.</i>	<p>In groups, research topics in science pertaining to your industry. Have students assign roles for each member of the group.</p> <p>Present findings in report format, or in oral presentations.</p> <p>Investigate science ethics.</p> <p>Recognize the processes available for accountability in industry. For example, OSHA has a Safety and Health Program Assessment Worksheet whereby employers can be rated for safety issues. See http://www.osha.gov/SLTC/safetyhealth_ecat/mod3.htm</p> <p>[Note: Safety and Health is a mandatory subject of bargaining when a workplace is unionized; in both unionized and non-unionized workplaces, an employer cannot create and dominate workplace safety committees (see the National Labor Relations Act).]</p>
<i>Use scientific instruments to measure aspects of the environment.</i>	Gather data on time, length, mass, pressure, volume, acceleration or other measureables using instruments from the job.
<i>Demonstrate an understanding of data.</i>	<p>List the processes involved in gathering data.</p> <p>Suggest ways that data can be grouped or organized.</p> <p>Collect specimens.</p> <p>Show how data can be represented (graphically, charts and diagrams, etc)</p> <p>Construct a model to depict a basic concept.</p>
<i>Identify the seven basic S I (Systeme International) units.</i>	<p>Length- meter- m</p> <p>Mass- kilogram- kg</p>

	Time- second- s Electric current- ampere- A Temperature- Kelvin- K Amount of substance- mole- mol Luminous intensity- candela- cd Dictionary of units- see http://www.ex.ac.uk/cimt/dictunit/dictunit.htm
Identify S I (Systeme International) Derived units.	Choose units appropriate to your industry (hertz, ohm, volt, watt, etc). Create a picture dictionary demonstrating the concepts.
Review relevant theories, laws and models.	As relating to your industry, discuss important theories, laws and models.
Use reference tools to solve problems.	Use scientific reference tools (such as the Periodic Table of Elements) to learn more about specific industry concepts.
Practice safe lab procedures.	Handle equipment with care. Demonstrate safety and first aid procedures. Identify harmful substances.
PHYSICAL SCIENCE	
Understand the cyclical nature of systems.	Show, demonstrate, model, track the cycles of any of the following systems: Growth and decay Food webs Weather Water
Analyze/classify matter according to type.	Identify types of matter (solids, liquids, gases). Which types are predominantly used in your area of industry?
Explain the concepts of work and power.	Identify machines used in industry. Identify how energy levels change when work or

	<p>power is increased/decreased. Identify fuel sources used in your industry.</p> <p>Discuss internal and external combustion. Create a model demonstrating the uses of levers and pulleys.</p>
<i>Be familiar with concepts of motion.</i>	<p>Measure acceleration and deceleration</p> <p>Understand the relationship between speed and velocity by performing experiments.</p> <p>Recognize waves and vibrations as a type of motion.</p> <p>Understand action and reaction.</p> <p>Review laws pertaining to motion.</p>
<i>Understand concepts related to force.</i>	<p>Show the need for balance of forces acting on an object.</p> <p>Observe centrifugal and centripetal forces in action.</p> <p>Show how friction is created and must be accounted for in using and preserving equipment.</p> <p>Create a chart showing types of lubricants needed in a factory and schedule of maintenance.</p> <p>Understand, at a level of complexity appropriate to your industry and to students' ability levels, basic principles of inertia.</p> <p>Show the relationship between pressure, mass, and weight.</p>
<i>Understand and apply principles relating to the atom.</i>	<p>Understand that atoms have a positive, negative or neutral charge. (Classify protons, electrons, and neutrons.)</p> <p>Identify ions.</p>

<p><i>Investigate forms of and changes in energy.</i></p>	<p>Discuss how energy is measured.</p> <p>Observe changes in energy relationships. Identify catalysts and reactants.</p> <p>Identify sources of kinetic and potential energy in your industry.</p>
<p><i>Discuss, apply principles of electricity and electric currents.</i></p>	<p>Identify types of circuits and switches.</p> <p>Show the difference between direct and alternating currents. Give examples of the best/most efficient use of each.</p> <p>Determine how electricity is measured, and solve problems using these terms. (Example, use Ohm's law to calculate current, resistance, and voltage.)</p> <p>Identify good conductors and insulators, and how to choose them.</p> <p>Understand grounding and create a visual display of grounding safety practices. Include the threat of static electricity.</p> <p>Show the uses of a vacuum tube by building a model.</p> <p>Compare the following ways of generating electricity: Hydroelectricity Motors Solar Power Steam/nuclear Transformers Incandescent (Light) Show the implications for your industry.</p> <p>As appropriate to your industry, identify electrochemical energy sources (cells, electrodes, batteries) and the processes of oxidation and reduction.</p>
<p><i>Be familiar with sound waves.</i></p>	<p>Compare how sound waves travel between</p>

	<p>liquids, solids, and air.</p> <p>Examine different types (lengths) of sound waves. Examine decibels safe for human hearing. Identify safety precautions for industry regarding sound tolerance.</p> <p>Be able to use correctly the terms below as they relate to your industry. (For example, ask students to write a short essay explaining a demonstration from class and include the following terms):</p> <p>Amplification Audible range Frequency Acoustics Resonance Speed</p>
<i>Be familiar with principles of heat.</i>	<p>Differentiate between the 3 types of heat transfer (conduction, convection, radiation).</p> <p>Understand that substances expand and contract due to heating and cooling</p> <p>Identify purpose and types of insulations used.</p> <p>Differentiate between heat and temperature.</p>
<i>Investigate and apply concepts relating to temperature.</i>	<p>Use the temperature scales; convert between Celsius and Fahrenheit.</p>
<i>Explain the concepts of magnetism.</i>	<p>Understand that currents create magnetic fields.</p> <p>Identify materials that are good conductors, and the properties that make them such.</p> <p>Understand electromagnetic forces present in earth.</p>
<i>Investigate/apply chemical properties.</i>	<p>Differentiate between acids and bases. Find pH for substances used in industry.</p> <p>Identify substances used in your industry and classify them by type.</p> <p>Name the major drugs, fertilizers, or additives</p>

	<p>used in your industry. Define and state examples of chemical reactions.</p> <p>Be familiar with solutions used in your industry. Compare saturated and unsaturated solutions. Determine whether a solution is soluble or insoluble. Explain solute and solvent.</p>
<i>Investigate forms of and changes in matter.</i>	<p>Compare and contrast physical and chemical changes.</p> <p>Discuss the types of physical or chemical changes that take place in your industry, from processing raw materials to manufacturing.</p>
<i>Understand and apply concepts relating to the elements.</i>	<p>Examine the 4 elements that make up 99% of living organisms (Hydrogen (H), Oxygen (O), Nitrogen (N), and Carbon (C)).</p> <p>Element Groups: Alkali Metals Alkaline Earth Metals Transition Metals Other Metals Metalloids Non-Metals Halogens Noble Gases Rare Earth Elements</p>
<i>Be familiar with principles of light.</i>	<p>Discuss light as a form of energy.</p> <p>Describe types of lighting systems.</p> <p>Examine the light spectrum and note the relative smallness of visible light.</p> <p>Define reflection and refraction.</p> <p>Explain how light carries information (by lasers) and show examples of the impact on technology/industry.</p> <p>Identify types of lenses.</p>

<i>Be familiar with principles of color.</i>	<p>Diagram the main parts of the eye involved in seeing color (rods, cones).</p> <p>Use prisms to split light into the visible spectrum. Briefly explore color blindness. What precautions should colorblind persons take regarding workplace safety?</p> <p>Define situations in which colorblindness impacts a worker's ability to do his job.</p>
LIFE SCIENCE	
<i>Explain the presence of cells as the identifier of all living organisms.</i>	<p>Examine the cells of organic material used in your industry, using books, the internet, or a microscope.</p> <p>Recognize that cells divide or replicate to promote growth of an organism.</p> <p>Examine the parts of a cell. Compare the cell to a machine...how do the parts function and rely on each other?</p> <p>Give example of one-celled and multiple-celled organisms.</p> <p>Review the classification system of all organisms (Kingdom, Phylum, etc).</p> <p>Create a circle graph or pie chart (totaling 100%) showing the relationship (in numbers) between the groups of organisms:</p> <p>Bacteria Fungi Viruses Insects Plants Vertebrates Invertebrates</p> <p>Compare some of the cell processes (active and passive transport) to the processes in your industry.</p>
	Recognize how a species will adapt to better fit in

<i>Understand the progress of evolution of organisms.</i>	its environment over time.
<i>Explain the role of genetics in human development.</i>	<p>Understand, at a level of complexity appropriate to your industry and to students' ability levels, basic principles of heredity, including:</p> <ul style="list-style-type: none"> • Half of an individual's genes are contributed by each parent • Traits that are inherited are either dominant or recessive from the parent(s) • Cell division by mitosis versus meiosis • Disabilities are caused either by genetic/inherited conditions (such as Down's Syndrome) or in accidents occurring after birth, such as brain damage due to a car accident or a stroke
<i>Investigate/apply principles of human development.</i>	<p>Describe the life cycle of humans and other animals.</p> <p>Use the concept of human development to explain the need for understanding foundation skills in your area. (For example, children do not run before they walk.) Use this concept to explain other events that occur in a natural order in your industry.</p>
<i>Explore additional concepts pertaining to humans and other animals.</i>	<p>Give examples of ways organisms adapt to their environment.</p> <p>As relating to industry, review the concepts of:</p> <p>Aging Immune system Skin and Tissues Blood and hemoglobin Disease</p>
<i>Compare/contrast the differences between sexual and asexual reproduction.</i>	<p>Determine instances when understanding the concepts of sexual reproduction are important for your industry.</p> <p>Highlight the effects of unsafe working practices on unborn fetuses, or the dangers present for pregnant individuals working in industry.</p>
<i>Show a general understanding of the</i>	Explore the cost of lost wages and worker's

importance of health.	<p>compensation in the past year due to health problems.</p> <p>Research the most common health problems among workers (workers with safe jobs; workers with most hazards to health, etc)</p>
<i>Investigate</i> the food cycle.	<p>Identify food chains, food webs, food pyramids.</p> <p>Show how changes to the food cycle affect the environment and affect man.</p> <p>Name the food groups.</p>
<i>Understand</i> nutrition and the body's need for a diet that provides vitamins and minerals.	<p>Show an understanding of body systems (circulatory, nervous, digestive, etc) as they relate to industry.</p> <p>Identify deficient vitamins and minerals among a particular population (American workers, workers in specific environments, workers who do not go outdoors, or who always work outdoors) and the health risks associated with job types (office work, mining work, etc.)</p>
<i>Observe</i> health code/sanitation requirements.	<p>Research the development of health code and sanitation requirements, including OSHA.</p> <p>Compare/contrast workplaces of 1850, 1900, 1950, 2000 regarding health and safety.</p> <p>Discuss the most common workplace violations of health requirements and present in a graphic format (e.g., maps, charts).</p> <p>Discuss potential effects of ignoring health requirements.</p> <p>After identifying workplace hazards, create several plans to treat the problem. Debate the benefits of each.</p> <p>To avoid the threat of employers choosing ineffective means of ensuring safety on the job, locate MSDS sheets, first aid stations, personal</p>

	<p>protective equipment, worker's compensation claims offices/paperwork, etc.</p> <p>Using workplace materials*, locate the section on safety regulations. Ask students to rank order the items. Debate the importance of each. Determine the threat of ignoring regulations. Research which regulations are often disregarded.</p> <p>Explore proactive measures students can take to extend their health.</p> <p>Understand the importance of mental health in addition to physical health.</p>
<i>Investigate/apply</i> principles of anatomy and physiology.	<p>As relating to your industry, explore issues relating to anatomy and physiology.</p> <p>Skeletal system- study the bones of the arm, hand, and neck. Research carpal-tunnel syndrome.</p> <p>Fractures- identify the types of fractures and those most common to your line of work. Learn how to prevent falls.</p>
<i>Understand</i> basic principles of Ecology.	<p>Define ecology.</p> <p>Identify 5 major ways in which man interacts with the environment, especially as relating to your industry.</p> <p>Discuss the effectiveness of the media as compared to pro-science groups (such as Greenpeace) on the public's awareness of important environmental issues.</p> <p>Identify any areas of concern regarding waste/waste management in your industry.</p> <p>Show the difference between a niche, community, habitat, and ecosystem.</p> <p>Give examples of herbivores, carnivores, and omnivores. How does your industry use and serve each group?</p> <p>Understand predators' effects on food chains.</p>

	<p>Identify predators of industry.</p> <p>Explain the process of decomposition and decay.</p> <p>How does industry interfere with or interrupt these processes?</p>
<i>State the differences between viruses and bacteria.</i>	<p>Define viruses and bacteria.</p> <p>Explore viral and bacterial threats present in the workplace. How can they be prevented? How can they be treated?</p> <p>State the benefits of viruses and bacteria.</p> <p>Explain the recent increased resistance to drugs and antibiotics.</p>
<i>Understand basic concepts relating to plants.</i>	<p>Describe the interchange of oxygen and carbon dioxide between plants. Contrast to the way humans exchange oxygen and carbon dioxide.</p> <p>As relating to industry, review the concepts of:</p> <p>Fertilization</p> <p>Parts of plant, and functions of each</p> <p>Effects of temperature on plants</p> <p>Need for water and light</p> <p>Photosynthesis</p>
EARTH SCIENCE	
<i>Recognize earth's position in the universe.</i>	<p>As relating to your industry, identify relevant topics regarding</p> <p>Asteroids</p> <p>Comets</p> <p>Stars</p> <p>Galaxies</p> <p>Identify planets in the solar system.</p> <p>Compare and contrast earth to other planets.</p> <p>Create a model showing the relative size of earth within our solar system. Use mathematical relationships to make sure the scale is correct (earth is the size of ____ so the sun should be the size of ____).</p> <p>How do the phases of the moon and sun affect the</p>

	hemispheres?
Investigate history of the earth.	<p>Identify geological, chemical and other methods of determining the age of an object.</p> <p>Demonstrate that fossils and rocks are indicators of previous eras.</p> <p>As a class, create a timeline indicating the age of the earth. Include the various ages (Ice Age, etc) and the length of each.</p> <p>Make sure the timeline is drawn to scale. Assign each Age to a group and research the following: Weather Major events at beginning and end of age Organisms living during this time Factors that made the Age unique</p>
<i>Investigate</i> physical characteristics of the earth.	<p>Label/model the components of the earth.</p> <p>Understand, at a level of complexity appropriate to your industry and to students' ability levels, basic principles of gravity. Solve problems of longitude, latitude and time zones.</p> <p>Create a model of the ratio of land and water on earth.</p>
<i>Investigate</i> physical forces acting on the earth.	<p>Examine erosion and depletion of nonrenewable resources.</p> <p>Identify natural disasters such as hurricanes and earthquakes. Research the effects of a past disaster on a specific industry.</p> <p>Understand, at a level of complexity appropriate to your industry and to students' ability levels, basic principles of plate tectonics (the earth's surface is broken into large plates; movements of these plates over time causes earthquakes and other geologic activity).</p>

<i>Explain the basic components of earth's rotation.</i>	<p>Understand that the earth spins on its axis at an angle of 23 ½ degrees</p> <p>Identify the period of one complete rotation as a day; longer cycles of rotations identify the seasons.</p> <p>Discuss time zones.</p>
<i>Identify the earth's atmosphere and its components.</i>	<p>Identify the main elements in the earth's atmosphere (nitrogen and oxygen).</p> <p>Identify layers of the atmosphere, and the ozone layer.</p> <p>Explain concepts of air pressure.</p>
<i>Understand basic principles of the solar system.</i>	<p>Demonstrate how the sun strikes the earth at different angles depending on location.</p>
<i>Demonstrate the relationship between climate and weather.</i>	<p>Identify the factors that create weather.</p> <p>Show how landscape features are affected by changes in climate or weather.</p> <p>Identify the greenhouse effect. How does industry contribute to it?</p> <p>Describe the relationship between altitude and weather.</p> <p>Understand that changes in the weather may be seen as fronts that are put in motion by the jet stream.</p> <p>Identify types of precipitation.</p> <p>Differentiate between types of clouds.</p> <p>Understand the effect of winds, wind speeds, and impacts on vegetation.</p>
<i>Learn and apply concepts relating to the oceans.</i>	<p>Label the major oceans and seas.</p> <p>Determine the elements in ocean water (nearly all elements are present).</p>

	<p>Identify or draw the structural components of the ocean floor.</p> <p>Explain the relationship between the moon and the tides.</p> <p>Explore ways the ocean is used for power and business.</p>
<i>Investigate</i> principles of water.	<p>Identify the parts of the water cycle and the effects of the processes involved.</p> <p>Define water's chemical properties water is the universal solvent water has a neutral ph of 7 chemically, water is one atom of oxygen bound to two atoms of hydrogen)</p> <p>Measure salinity. Which industries rely heavily on water?</p> <p>Define water's physical properties water is the only natural substance that exists as solid, liquid, and gas water's surface has a high density water has a high tolerance for heat (heat index) water's weight water as a coolant specific gravity</p>
<i>Investigate</i> conservation of physical and natural resources.	<p>As relating to your industry, discuss or debate the issues of Allocation of resources Recovering resources Best/worst methods of using resources</p> <p>Compare/contrast renewable and nonrenewable resources.</p> <p>Note the important developments in your industry regarding mineral, soil, water, and wildlife conservation.</p> <p>Discuss alternative sources of energy as relating to your industry.</p>

<p><i>Investigate</i> issues regarding scientific technology.</p>	<p>As relating to your industry, discuss the uses of technology. What are the newest developments?</p> <p>What effects does the technology have on our society? Political system?</p> <p>Discuss the role of economics on technology.</p>
<p><i>Apply</i> science principles/laws to environmental issues.</p>	<p>Discuss how mankind alters the earth and environment through use of resources and technology, pollution.</p>

Crosswalk to SkillsUSA Construction Technology

SkillsUSA, the co-curricular student organization for Technical and Professional Education, provides many opportunities through its program of work for students to apply the knowledge, skills, and processes learned in a variety of courses. A correlation of the Masonry, Carpentry, Commercial Wiring, and Plumbing technical contests to selected tasks/competencies in Arkansas's Construction Technology courses are provided as a supplement to this framework.

MASONRY

Purpose

To evaluate each contestant's preparation for employment and to recognize outstanding students for excellence and professionalism in the field of masonry.

Clothing Requirement

Official SkillsUSA khaki work shirt and pants, black or brown leather work shoes, and safety glasses with side shields or goggles. (Prescription glasses can be used only if they are equipped with side shields. If not, they must be covered with goggles.) To purchase official work clothes, contact Midwest Trophy Manufacturing Co. Inc. by calling 1-800-324-5996 or order online at: <http://www.mwtrophy.com/vica/index.html>.

Eligibility

Open to active SkillsUSA members enrolled in programs with masonry or bricklaying as the occupational objective.

Equipment and Materials

- Supplied by the technical committee:
 - Tenders
 - Hose

- Three 55-gallon water drums
- Mortar pans, boards, pails, wheelbarrows
- Hoes
- Square-nosed, short-handled shovels
- Sand
- Masonry mix or ready-mixed mortar
- Resin paper or suitable area covering
- All necessary information and furnishings for judges and technical committee
- Supplied by the contestant:
 - One trowel
 - Two levels (24" and 48")
 - One "S" jointer
 - Long jointer
 - One brick hammer
 - Two six-foot folding rules (one modular, one standard)
 - One carrying bag
 - One pencil
 - One square
 - One brush
 - One brick chisel
 - Line and line blocks

Scope of the Contest

- Contestants will construct a project or wall system using brick or brick and block, according to project specifications and drawings, within an allotted period of time.
- Contestants will be rated on skills selected from the following list of competencies as determined by the SkillsUSA Championships technical committee. Committee membership includes: Associated General Contractors of America, Bon Tool Co., Brick Association of the Carolinas, Brick Institute of America, Marshalltown Trowel Co., Mason Contractors Association of America, National Concrete Masonry Association, Portland Cement

Association, Rich Mix Products, Southern Brick Institute, SPEC MIX Inc., and Turnkey Masonry Supply Co.

- Basic skills will consist of the following: Know and Understand Brick Masonry Techniques
 - *Choose proper tools and materials
 - *Perform work in a reasonable amount of time as determined by the instructor and/or industry standards
 - **Lay-up masonry products in an accurate and professional manner
 - *Load and unload materials as directed
 - *Clean up work areas properly and thoroughly
- General Safety
 - *Demonstrate appropriate safety precautions when performing all tasks
 - *Demonstrate awareness of potential hazards when performing all tasks
 - *Accept responsibility for the safety of other workers
 - *Keep work areas neat and organized
 - *Wear proper safety equipment and clothing
 - Follow prescribed OSHA standards
- Hand Tools and Equipment
 - *Cut masonry safely around others
 - *Place mortar cautiously in the mortar pan or on the mortar board
 - *Keep tools out of the paths of other people working on the job
 - *Handle tools properly
- Hand Tool Identification and Usage
 - *Identify basic hand tools used in brick masonry
 - *Demonstrate an understanding of the specific uses of each hand tool
 - *Practice the safety rules for each hand tool
 - *Identify quality tools
 - *Store and care for hand tools.218 *SkillsUSA Championships Technical Standards (2002–2004)*

- Measuring Tools
 - *Use and maintain a modular ruler and a spacing ruler
 - Set and use a story pole
- Power Tool Identification and Usage
 - *Identify the power tools used in brick masonry
 - *Demonstrate the specific uses of each power tool
 - *Practice the safety rules for each power tool
 - Maintain power tools
 - *Set up power tools correctly
- Equipment
 - *Identify equipment generally used in brick masonry
 - Correctly use each piece of equipment
 - Store, maintain and repair all equipment
 - Inspect, assemble, and disassemble rigging and scaffolding properly
- Masonry Levels
 - **Use a 24" and 48" level for plumbing and leveling
 - *Care for and maintain a level
- Fundamental Theory in Brick Masonry a. Trade Terminology
 - **Identify terms used in brick masonry
 - **Demonstrate ability to verbalize using trade terminology
- Basic Math
 - *Add, subtract, multiply and divide with whole numbers, decimals and fractions
 - *Figure proportions to mix masonry materials according to specifications
 - *Compute percentages to estimate and determine material requirements, work performed, schedules and costs
 - *Express answers relative to the trade
- Blueprint Readings
 - *Read basic drawings and sketches and understand the information contained in them
 - *Know the meanings of basic architectural symbols and abbreviations

- *Use a builder's level relative to a benchmark

Materials and Methods

- Brick Masonry Materials
 - *Arrange masonry materials for efficient use
 - *Place mortar pans properly
 - *Temper or shake-up mortar with proper shovels
- Hod-carrying
 - *Arrange masonry materials for efficient use
 - *Place mortar pans properly
 - *Temper or shake-up mortar with proper shovels
- Trowel Usage
 - **Manipulate a trowel properly
 - **Cut and roll, and cut and cup mortar to load trowel properly
 - **Spread and furrow mortar properly
- Preparation of Mortar
 - *Follow correct safety practices when mixing mortar
 - *Proportion mortar ingredients for specific mixes
 - *Mix mortar manually with hoe and mortar box
 - *Mix mortar with a mortar mixer
- Bonding Methods
 - *Demonstrate knowledge of different types of bonding used in masonry construction
 - **Lay out bond
 - **Determine coursing
- Tooling and Pointing Joints
 - **Tool concave joints
 - Tool rake, weather, V-jointer, grapevine and struck joints
 - Cut/rough joints
 - *Tuck-point a wall
 - **Brush and touch-up wall

- Cleaning Brick and Structural Tile
 - *Follow correct procedures for keeping masonry work clean
 - *Follow correct procedures in cleaning brick and structural tile
 - *Follow correct procedures for rubbing and tuck pointing concrete block and slag block
 - Clean and tuck-point stonework
 - Brick and Block Laying
- Lay Straight Brick Wall
 - *Lay brick at the rate of 75-100 brick per hour
 - **Attach a line block and line pins to a wall
 - **Set a trig
 - **Lay brick to a line while holding bond
 - **Throw a full head joint
- Lay Straight Block Wall
 - *Spread bedjoints and throw on full headjoints for block units
 - *Lay block units to the line. *Sponsored by Goodheart-Willcox Publisher 219*
- Building the Brick Corner
 - *Lay out a wall in preparation for building a brick corner
 - *Construct a rack-back lead
 - *Construct an outside and inside corner lead (+ or – 1 1 /16 ")
- Lay the Block Corner
 - *Lay out a wall in preparation for building a block corner
 - Install wire reinforcement in bed joints
 - *Build a block corner to a specified height
- Lay Brick Veneer Wall
 - Determine type of brick to be used
 - *Bond the wall
 - *Scale each course
 - *Lay brick in mortar to scale
 - *Secure wall with ties at desired intervals

- *Point and joint the wall
- Lay Brick Masonry Cavity Wall
 - *Determine width of cavity and type of brick to be used
 - *Construct components of the wall in the proper sequence
 - *Spread mortar to achieve the required bond without getting mortar into the cavity
 - **Install wall ties which join the exterior and interior wythes together into a single cavity wall
 - **Install flashings and construct weep holes in a manner that permits effective drainage of moisture from cavity
 - **Construct and maintain the cavity during construction so that the air space provides insulation
- Lay Single Wythe Brick (Load-bearing) Wall
 - Determine type of brick to be used
 - *Bond the wall
 - *Scale each course
 - *Lay brick in mortar to scale
 - **Secure wall with ties at desired intervals
 - *Point and joint the wall
- Lay a Brick and Block Composite Wall
 - Determine type of brick and block to be used
 - *Bond the wall
 - *Scale each course
 - *Lay brick and block in mortar to scale
 - *Secure wall with ties at desired intervals
 - *Point and joint the wall
- Fireplaces and Chimneys
 - Identify various components of a fireplace
 - Build a fireplace according to plans
 - Identify various components of a chimney

- Build a one-flue chimney from given plans
- Arches, Columns and Piers
 - Demonstrate knowledge of architectural features including aesthetic trims, course designs, period and antique applications
 - Construct an arch using given plans
 - Construct a column using given plans
 - Construct a pier using given plans
- Floors, Pavers and Stairs
 - Lay floors according to given plans
 - Lay pavers according to given plans
 - Lay stairs according to given plans
 - Concrete Work
- Footer Preparation
 - Lay out footings properly
 - Place rebar properly
 - Place and rough finish concrete properly
- Foundations
 - Lay out and establish grades for foundation
 - *Establish corners and lay out concrete block according to specific bonding plan
 - Lay foundation wall to joist and brick shelf height
 - Waterproof foundation wall
 - *Install flashing, anchor bolts, termite shield and weep holes

* Considered essential competencies

** Should be mastered at the journeyman level of performance

All other items are considered supplemental..216 *SkillsUSA Championships Technical Standards (2002–2004)*

Written test

CLOTHING PENALTY (minus 0 to 5 percent of total points)

Note: An Oral Professional Assessment will be included. Points to be determined by national technical committee..220 *SkillsUSA Championships Technical Standards (2002–2004)*

CARPENTRY

Purpose

To evaluate each contestant's preparation for employment and to recognize outstanding students for excellence and professionalism in the field of residential and commercial carpentry.

Clothing Requirement

Official SkillsUSA khaki work shirt and pants, black or brown leather work shoes, and safety glasses with side shields or goggles. (Prescription glasses can be used only if they are equipped with side shields. If not, they must be covered with goggles.) To purchase official work clothes, contact Midwest Trophy Manufacturing Co. Inc. by calling 1-800-324-5996 or order online at: <http://www.mwtrophy.com/vica/index.html>.

Eligibility

Open to active SkillsUSA members enrolled in programs with carpentry as the occupational objective.

Safety Requirement

Both the instructor and the contestant certify by agreeing to enter this contest that the contestant has received instructions and has satisfactorily passed an examination on the safe use of a portable power saw. They also certify that the contestant's saw has been thoroughly inspected and is in safe working condition. Further they agree that SkillsUSA Inc., the SkillsUSA Championships technical committee and national judges are released from all responsibility relating to personal injuries resulting from its use. Contestants will be removed from competition if proper training has not been provided and/or they are using the equipment in an unsafe manner.

Equipment and Materials

- Supplied by the technical committee
 - Sufficient lumber for two 2'x4' sawhorses for each contestant
 - All lumber and materials, as specified on the job sheet
 - Job sheets and blueprints for each contestant and judge
 - All necessary information and furnishings for judges and technical committee
 - Hard hat
- Supplied by the contestant:
 - Four portable sawhorse brackets (steel or plastic) that accept 2"x4" lumber only
 - One 8 pt. crosscut saw (10 pt. or 12 pt. optional)
 - Claw hammers (1 trim and 1 framing)
 - One set chisels (1 /4 " to 1")
 - Framing square
 - 6' folding rule and/or 16' or longer steel tape measurer
 - Utility knife with standard and hookbill blades
 - Two pencils
 - One each—1 and 2 pt. Phillips and 4" and 8" standard screwdrivers
 - Wrecking bar or gooseneck pinch bar
 - Coping saw and extra blades
 - Cat's paw (nail puller)
 - Chalk box and line
 - One each 1 /32 ", 2 /32 " and 3 /32 " nail sets
 - Straight aviations nip or any metal cutting snips
 - 24" or 30" spirit level
 - Blockplane
 - Combination wood rasp and file (8")
 - Carpenter's tool and nail pouch with belt and/or suspenders
 - Stair gauges (optional)
 - One pair slip joint pliers
 - Combination square and/or speed square

- 25' power cord (UL approved grounded)
- Calculator
- Power circular hand saw with new carbide-tipped blade
- Other power tools may be added with one year's advanced notice to the state SkillsUSA associations

Scope of the Contest

Contestants will demonstrate their ability to perform jobs and skills selected from the following list of competencies considered essential by the SkillsUSA Championships technical committee. Committee membership includes: Associated General Contractors of America Inc., Home Builders Institute, North American Steel Framing Alliance, R.S. Means Co. Inc. and Salt Lake City Community College.

- **Blueprints and Specifications**

- Interpret and determine dimensions from multi-view drawings
- Interpret specifications and drawing notes
- Identify plot plan information such as reference points and bench marks
- Interpret oral and written changes
- Understand common abbreviations and symbols
- Interpret door, window and finish schedules

- **Building Site**

- Use builder's level and transit properly for layout and elevation.150 *SkillsUSA Championships Technical Standards (2002–2004)*

- **Building Materials**

- Identify, receive and inspect materials
- Store lumber and other materials properly

- **Foundations and Forms**

- Construct and align various footing forms to include keyways, bulkheads, dowels and anchorages
- Construct and align foundation wall and wall forms to include pilasters and beam pockets
- Construct and align column and pier forms
- Maintain form materials properly

- **Rough Framing**

- Identify framing members and select materials
- Frame and install sill plate, girders, floor joists and bridging
- Frame floor opening and sub floor
- Build or erect safe scaffolding
- Frame and brace walls to include corners, openings, trimmers, cripples, partitions, plumbing partitions, fixture backing and sheathing
- Frame stair stringer and other components

- **Roof Framing**

- Identify types and components of roof construction
- Determine rafter lengths from a rafter scale
- Calculate and use the rise and run of a common roof
- Lay out a common roof plan
- Lay out, cut and install common rafters, ridge board, collar ties, gambrel rafters, valley rafters, valley jack rafters, tail rafters, hip rafters, hip jack rafters and cripple jack rafters
- Frame roof openings, dormers and saddles
- Build roof trusses; and layout, cut and install purlins
- Install roof sheathing

- **Exterior Finish**

- Construct, install and trim window and door frames
- Install corner boards, molding or metal corners
- Install wood bevel and lap siding and aluminum or vinyl siding
- Install wood shingles and miter corners
- Exterior finish rake, open cornice and box cornice

- **Interior Finish**

- Install gypsum board
- Cut and install paneling and trim
- Fit and hang doors and trim to include swinging, sliding, folding and pocket doors
- Construct closets and built-in units and install accessories
- Cut and install crown molding or other moldings

- **Stairs**

- Lay out a straight run stringer and a two-flight stringer set with landing using a carpenter square
- Calculate rise, run and tread width
- Cut and install stair treads and stair skirt

- **Lumber**

- Match letters designating uses in plywood or composition board to their current application
- Match common hardwoods and softwoods to their uses
- Identify types of trim and moldings
- Identify common defects in lumber
- Write a requisition for ordering lumber
- Compute board feet

- **Tools** - Safely use and maintain the following:
 - Hand Tools
 - Sliding T-bevel
 - Tape measurer
 - Combination square/speed square
 - Coping saw
 - Keyhole saw
 - Folding rule
 - Hammer
 - Punch
 - Hand saw
 - Nail set
 - Wood chisel
 - Carpenter's level
 - Framing square
 - Hand plane
 - Power Tools
 - Reciprocating (jig saw)
 - Miter saw
 - Hand drill
 - Belt sander
 - Circular hand saw
 - Sabre saw
 - Table saw
 - Hand plane
 - Finish sander
 - Hand router
 - Pneumatic nailers

Time limit

Contestants will be stopped when time limits, as specified on the contest job sheet, are up; however, contestants may stop whenever they have completed a particular phase of the contest.

2. The dismantling of the project will be considered the final sequence or task of this contest.

Note: If desired, a contestant may choose to use a standard handsaw without penalties.

Sponsored by Goodheart-Willcox Publisher 151

Items Evaluated

- Use and care of tools
- General safety: job site and power tool operation
- Layout of work (accuracy, best use of materials)
- Construction (accuracy of cuts, best use of materials, fitting of joints)
- Assembly (assembly according to plans, sequence of construction, overall appearance of project)
- General workmanship (ability to follow plans, ability to follow written directions, quality of workmanship)

Note: An Oral Professional Assessment will be included. Points to be determined by national technical committee..152 *SkillsUSA Championships Technical Standards (2002–2004).**Sponsored by Goodheart-Willcox Publisher 153*

Residential Wiring

Purpose

To evaluate each contestant's preparation for employment and to recognize outstanding students for excellence and professionalism in the field of residential wiring.

Clothing Requirement

Official SkillsUSA khaki work shirt and pants, black or brown leatherwork shoes, and safety glasses with side shields or goggles. (Prescription glasses can be used only if they are equipped with side shields. If not, they must be covered with goggles.) To purchase official work clothes, contact Midwest Trophy Manufacturing Co. Inc. by calling 1-800-324-5996 or order online at: <http://www.mwtrophy.com/vica/index.html>.

Eligibility

Open to active SkillsUSA members enrolled in programs with residential wiring or electrical trades as the occupational objective.

Equipment and Materials

- Supplied by the technical committee:
 - All wiring panels, electrical supplies and materials as required by the problem assigned
 - All necessary information and furnishings for judges and technical committee
- Supplied by the contestant:
 - Diagonal pliers
 - Side cutters
 - Hacksaw
 - Claw hammer
 - Needle nose pliers
 - Arc joint pliers
 - Torpedo level
 - Assorted flat blade and Phillips screwdrivers

- Keyhole saw
- Assorted wood chisels 1 /4 " to 1"
- Measuring tape or ruler
- Wire strippers
- Knife
- 1/2 " EMT bender
- Scratch awl
- Cordless electric hand drill with extra battery pack
- 3 /4 " spade bit
- Test meter
- Conduit reamer
- Volt/ohm meter
- *National Electrical Code* book (most current)

Scope of Contest

- Contestants will be given job, information and instruction sheets for wiring a residence or light commercial installation.
- All work must conform to the specifications of the latest edition of the *National Electrical Code* as of January prior to the SkillsUSA Championships.
- Contestants will demonstrate their ability to perform jobs or skills selected from the following list of competencies as determined by the SkillsUSA Championships technical committee. Committee membership includes: International Brotherhood of Electrical Workers, National Joint Apprenticeship Training Committee and D.F. Patton & Associates.
- Safety Rules and Practices
 - Application of shop rules and regulations
 - Techniques and practices of fire prevention
 - Correct use of electrical and hand tools
 - Techniques of lifting and climbing ladders
 - Selection of work clothing
 - Installation of temporary electrical service

- Maintaining a safe work area
- Use of Tools and Equipment
 - Use of and dexterity with hand tools
 - Use and connection of electrical test equipment
- Basic Theory
 - Use wiring diagrams, schematics/drawings and prints
 - Apply math calculations for circuits and measurements
 - Application of theory concepts for troubleshooting
- Trade Information
 - Use of the *National Electrical Code Handbook*
 - Use of techniques of sketching and diagramming correlating specifications, prints and job sites
 - Planning work and layout of electrical installations
 - Use of trade catalogs and publications
- Basic Equipment and Procedures
 - Techniques of residential and light commercial wiring
 - Techniques of wire pulling—such as conduit raceways or gutters
 - Use and application of electrical devices and materials
- Electrical Circuits
 - Computing service loads
 - Calculate individual circuit loads
 - Determine the number of outlets permitted in circuits.254 *SkillsUSA Championships Technical Standards (2002–2004)*
 - Compute the size of service entrance conductors
 - Use of all types of cables—NM, MC, and service
- Install Service Entrance
 - Install main service panel
 - Install circuit breakers in panel
 - Install service entrance cable to service drop
 - Install temporary electrical service

- Install Switch Boxes and Outlet Boxes

- Install barhangers
- Install recess boxes for outlets
- Install gangable boxes
- Install octagon boxes
- Install surface mount boxes
- Install recessed fixture housing in ceiling

Install outlet boxes in a dry wall, lath, plaster or paneled walls

- Maintain Existing Wiring

- Diagnose and repair/replace incandescent lights
- Replace existing receptacles and switches
- Troubleshoot a branch circuit
- Test for correct voltages

- Rough In, Connect and Install these Electrical Devices

- Single pole switch
- Three-way switch
- Four-way switch
- Duplex-grounded receptacle
- 120-240 volt distribution panel
- Door chime system
- Ground fault interrupting devices
- Emergency warning system
- Photoelectric cell control
- Surface raceway
- Exterior lighting fixtures
- Lighting dimmers
- TV outlets
- Telephone outlets
- Emergency lighting systems
- Appliance circuits

- Install PVC and EMT conduit - Make the following bends:
 - 90-degree offsets, back to back, offset over object, and saddle
 - Bends will be made from measurements
 - Determine correct conduit measurements

(The use of AC power-operated tools is not permitted. *Sponsored by Goodheart-Willcox Publisher 255*)

CONTESTANT NUMBER ITEMS EVALUATED

- Accuracy
- NEC
- Safety
- Height
- Depth
- Material Selection
- Grounding
- Device Connections
- Splice Connections
- Box Neatness
- Panel
- Conduit
- Project Neatness
- Written Test

SUBTOTAL

CLOTHING PENALTY

(Minus 0 to 5 percent of total points)

Note: An Oral Professional Assessment will be included. Points to be determined by national technical committee. .256 *SkillsUSA Championships Technical Standards (2002–004)*. *Sponsored by Goodheart-Willcox Publisher 257*

PLUMBING

Purpose

To evaluate each contestant's preparation for employment and to recognize outstanding students for excellence and professionalism in the field of residential plumbing.

Clothing Requirement

Official SkillsUSA light blue work shirt and navy pants, black or brown leatherwork shoes, and safety glasses with side shields or goggles. (Prescription glasses can be used only if they are equipped with side shields. If not, they must be covered with goggles.) To purchase official work clothes, contact Midwest Trophy Manufacturing Co. Inc. by calling 1-800-324-5996 or order online at: <http://www.mwtrophy.com/vica/index.html>.

Eligibility

Open to active SkillsUSA members enrolled in programs with residential plumbing as the occupational objective.

Equipment and Materials

- Supplied by the technical committee:
 - All necessary supplies and appliances required for the project
 - All necessary information and furnishings for judges and technical committee
 - Tank and tips will be provided
- Supplied by the contestant:
 - 8' steel tape measure
 - Copper tubing cutter with reamer
 - Striker
 - Arc joint pliers (channel lock type)
 - 8" or 10" adjustable wrench
 - Set of assorted slotted and Phillips screwdrivers
 - Torpedo level
 - 14-16 oz. claw hammer

- Plastic (P.V.C.) pipe reamer or suitable knife
- Suitable saw or shear to cut P.V.C. pipe
- Small can solder flux or paste, 1 /2 -lb. roll solder and solder paste brush
- Copper cleaning tool (inside and outside)
- Roll of plumbers' emery cloth
- 12" architect's scale
- 2H pencil and eraser
- 12" straightedge or drafting triangle
- Cutters suitable for cast-iron soil pipe
- Torque wrench for no-hub clamps
- Straight tin snips
- 5 /16 " nut driver
- Hacksaw
- 3 /8 " drive socket set
- Portable battery screw gun
- Plumb bob

Scope of the Contest

Contestants will demonstrate their ability to perform jobs or skills selected from the following list of competencies as determined by the SkillsUSA Championships technical committee. Committee membership includes: Anthony Mechanical Contractors, Kenney's Plumbing & Heating, National Association of Plumbing-Heating-Cooling Contractors, and New Jersey Association of Plumbing-Heating-Cooling Contractors.

Tools and Equipment

- Basic Hand Tools
 - Measure lines to the nearest 1 / 16 of an inch with a rule/tape measure
 - Identify and use common hand tools basic to the plumbing trade
- Power Tools
 - Attach various hangers on concrete, metal and wood walls

- Cut out an opening in plywood or wood for various pipes and fixtures
- Thread steel pipe with a power-driven thread cutter
- Equipment
 - Light and adjust the air-acetylene torch
 - Set up and adjust the builder's level
 - Set up and light a propane furnace
 - Set up an inflatable rubber test plug in a pipe
 - Set up a mechanical test plug in a pipe
 - Blueprints, Measurements and Calculations
- Blueprint Reading
 - Read the architect's scale
 - Develop an isometric sketch of a drainage system
 - Determine measurements from a manufacturer's specifications
 - Determine rough-in locations
 - Establish grade lines for installing plumbing
 - Convert weight (mass) measurements from English system to metric system
 - Systems Rough-In
- Drainage Systems
 - Label a cross-section of a P-trap
 - Identify fittings required on a drain-age system
 - Install bathtub waste overflow and trap
 - Calculate the slope required for building sewer lines
 - The contestant may not bring extra fittings to the contest..236 *SkillsUSA Championships Technical Standards (2002–2004)*
 - Install soil or waste back vents
 - Install cleanouts on drains
 - Rough-in waste lines and vents for built-in lavatories
 - Rough-in waste lines and vents for bathtubs
 - Secure horizontal and vertical lines of pipe to wood, metal and masonry surfaces

- Water Systems
 - Make an isometric drawing of a hot and cold water system for a two-story house
 - Determine pipe sizes for a hot and cold water system for a two-story house
 - Rough-in water supply lines for bathtubs
 - Rough-in water supply lines for water closets
 - Rough-in water supply lines for water heaters
 - Make water pressure tests on water supply systems
- Joining Pipes
 - Cut, ream, thread and join steel pipe
 - Measure, cut and join cast iron pipe to a cast-iron fitting using the caulking method
 - Join cast iron pipe to a cast iron fitting using a no-hub joint
 - Join cast iron pipe to a cast iron fitting using a compression joint
 - Cut, ream and join copper tubing using the sweat method
 - Cut, ream and join copper tubing using a compression joint
 - Cut, ream and join copper tubing using a flare joint
 - Join cast iron pipe to a P.V.C. pipe using a no-hub joint.
 - Join cast iron pipe to a P.V.C. pipe using a P.V.C. adapter
 - Join P.V.C pipe to P.V.C. fittings
- Pipe and Pipe Fittings
 - Read fitting sizes
 - Identify fittings from a sketch of a piping system
 - Construct a materials take-off list from an isometric drawing
 - Residential Systems
 - Compute the cost for plumbing supplies
 - Perform leak tests on various piping systems
 - Fixture and Appliance Installation
- Water Valves and Faucets
 - Install a kitchen sink faucet
 - Install a dual control lavatory faucet with pop-out drain plug

- Disassemble and reassemble a single kitchen sink faucet
- Drainage Connections
 - Install a cast iron water closet flange
 - Install a plastic water closet flange
 - Install a lavatory trap
 - Install a kitchen sink trap
- Fixtures and Appliances
 - Install a water closet (floor mount)
 - Install a lavatory (wall hung type)
 - Install a bathtub
 - Install an electric water heater
 - Install a dishwasher
 - Install a garbage disposal unit
 - Install a gas water heater
 - System Maintenance and Repair
- Water Systems Maintenance and Repair
 - Replace a section of galvanized water supply line
 - Thaw a frozen pipe with a plumber's torch
 - Repair a leaking water faucet or valve
 - Repair a leaking shower valve
 - Repair a ball cock on a water closet
 - Insulate water lines
- Drainage Systems Maintenance and Repair
 - Replace a lavatory trap
 - Clear obstructions from a lavatory drain
 - Clear obstructions from a water closet drain
 - Clear obstructions from a main drain line

All piping will be visually inspected and may be tested for leaks. *Sponsored by Goodheart-Willcox Publisher 237*

Items Evaluated

- DWV
- Accuracy
- Installation
- Grade
- Alignment
- Supports
- Fixtures
- COPPER
- Accuracy
- Installation
- Plumb
- Joint Preparation
- Solder Joint
- NEATNESS
- SAFETY

WRITTEN TEST

CLOTHING PENALTY (minus 0 to 5 percent of total points)

Note: An Oral Professional Assessment will be included. Points to be determined by national technical committee..238 *SkillsUSA Championships Technical Standards (2002–004)*. Sponsored by Goodheart-Willcox Publisher 239

Arkansas's All Aspects of Industry

Defining “All Aspects”

All aspects of an industry include, with respect to a particular industry that a student is preparing to enter, planning, management, finance, technical and production skills, underlying principles of technology, labor and community issues, health and safety, and environmental issues related to that industry. Planning is examined at the level of both an individual business and the overall industry. Planning elements might include:

- Developing strategic plans — mission, vision, goals, objectives, and/or a plan of action
- Working with planning tools such as surveys, market research, and competitive analysis
- Anticipating needs for staffing and major purchases of equipment and supplies
- Developing plans for training and upgrading of staff
- Forecasting market trends
- Developing business plans for entrepreneurial ventures.

Management addresses methods typically used to manage enterprises over time within the industry, as well as methods for expanding and diversifying workers' tasks and broadening worker involvement in decisions. Key elements of management might include:

- Using an organization chart to explain how a corporate chain of command works
- Providing input for strategic plans and communicating the company's vision and mission statements
- Leading employees in carrying out strategic plans and action plans
- Evaluating employee performance
- Anticipating technology and other major purchasing needs
- Ensuring equity and access for employees
- Resolving conflicts
- Developing job descriptions and written policies/procedures
- Identifying recruitment procedures, training opportunities, methods of evaluation, and retention strategies
- Working with professional associations and community outreach efforts.

Finance examines ongoing accounting and financial decisions and different methods for raising capital to start or expand enterprises. Finance functions might include:

- Developing budgets
- Preparing financial statements
- Analyzing and managing financial transactions and records
- Implementing payroll procedures
- Determining and paying taxes
- Identifying indirect wage costs (benefits, FICA, insurance, worker's compensation)
- Making loans and granting credit to customers
- Developing graphs and charts related to company finances
- Identifying and implementing methods of sustaining profitability of a business
- Managing 401K plans
- Identifying sources of capital

Technical and Production Skills cover specific production techniques and alternative methods for organizing the production work, including methods that diversify and rotate workers' jobs. Technical and production skills that an employee should have to succeed in a business or industry might include:

- Developing and upgrading job-specific skills
- Using troubleshooting and problem-solving techniques
- Analyzing information to make decisions
- Identifying and implementing quality assurance techniques
- Employing communication skills such as writing, listening, speaking, and reading
- Participating in team efforts
- Implementing projects and new techniques
- Demonstrating basic computer skills; employing time management techniques in completing projects and assigned tasks
- Demonstrating ethical behavior and work ethic.

Underlying Principles of Technology provide an integrated study across the curriculum of the mathematical, scientific, social, and economic principles that underlie the industry's technology.

Principles of technology that an employee should know might be demonstrated by:

- Exhibiting proficiency in mathematical and scientific functions related to new and emerging technologies
- Continuously upgrading job skills needed to implement new technologies
- Participating in industry certification programs
- Cross-training to enhance one's value to the organization and to enhance job promotion opportunities
- Understanding and adhering to ethical issues related to technologies.

Labor Issues examine worker rights and responsibilities, labor unions and labor history, and methods for expanding workers' roles. Labor issues might include:

- Understanding and implementing worker rights and responsibilities
- Working with labor unions
- Keeping abreast of local, state, and federal legislation affecting employee and employer rights and responsibilities
- Negotiating and settling worker disputes
- Identifying certification requirements for specific jobs
- Analyzing the impact of labor agreements on business operations.

Community Issues explore the impact of the industry on the community and the community's impact on and involvement with the industry. Concepts of business and community relations might include:

- Developing and working with community outreach projects
- Participating on advisory committees and community organizations
- Working with professional associations
- Developing and implementing public relations plans
- Participating in community service projects.

Health, Safety, and Environmental Issues examine these concepts in relation to both the workers and the larger community. Concepts related to health, safety, and the environment might include:

- Identifying and implementing federal, state, and local regulations related to the health and safety of employees
- Understanding and strictly adhering to federal, state, and local environmental regulations related to the business
- Identifying job-specific health hazards and safety issues
- Identifying and implementing basic safety and first aid training techniques for emergencies such as personal illness or injury, tornadoes, fires, nuclear accidents, floods, and incidences of employee-rage or violent behavior
- Communicating safety regulations and plans to employees

Working with selected community groups to implement safety programs.

Construction Technology Framework Cross Reference

Fundamentals of Construction

Unit 1	Free Enterprise System	Duty(s):
Unit 2	America's Infrastructure	Duty(s):
Unit 3	Starting a Business	Duty(s):
Unit 4	Industry Orientation	Duty(s):
Unit 5	Becoming a Good Leader	Duty(s):
Unit 6	Job Advantages	Duty(s):
Unit 7	Orientation to Safety and Basic First Aid	Duty(s):
Unit 8	Basic Math	Duty(s):
Unit 9	Measuring	Duty(s):
Unit 10	Basic Plan Reading	Duty(s):
Unit 11	Builder's Level and Transit	Duty(s):
Unit 12	Site Layout	Duty(s):
Unit 13	Tools and Equipment Related to All Crafts	Duty(s):
Unit 14	Ladders and Scaffolds	Duty(s):
Unit 15	Rigging and Material Handling	Duty(s):
Unit 16	VICA Student Organization	Duty(s):

Bricklaying

Unit 1	Bricklaying Materials	Duty(s):
Unit 2	Bricklaying Tools	Duty(s): A
Unit 3	Bricklaying Layout	Duty(s): B,C
Unit 4	Bricklaying Basic Skills	Duty(s): C,D,E,F,G,H
Unit 5	VICA Student Organization	Duty(s): A,B

Carpentry

Unit 1	Carpentry Materials	Duty(s): J,L
Unit 2	Carpentry Tools	Duty(s): I
Unit 3	Carpentry Layout	Duty(s): K,O,P,Q
Unit 4	Carpentry Basic Skills	Duty(s): M,N,R,S,T,U,V,W
Unit 5	VICA Student Organization	Duty(s): A,B

Concrete

Unit 1	Concrete Materials	Duty(s): A
Unit 2	Concrete Tools	Duty(s): B
Unit 3	Concrete Layout	Duty(s): C,AA
Unit 4	Concrete Basic Skills	Duty(s): AA
Unit 5	VICA Student Organization	Duty(s): A,B

Drywall Materials

Unit 1	Drywall Materials	Duty(s): BB
Unit 2	Drywall Tools	Duty(s): CC
Unit 3	Drywall Layout	Duty(s): DD
Unit 4	Drywall Basic Skills	Duty(s): EE
Unit 5	VICA Student Organization	Duty(s): A,B

Electricity

Unit 1	Electrical Materials	Duty(s): II
Unit 2	Electrical Tools	Duty(s): GG,II
Unit 3	Electrical Layout	Duty(s): JJ,PP
Unit 4	Electrical Basic Skills	Duty(s): LL,MM,NN,OO
Unit 5	VICA Student Organization	Duty(s): A,B

Plumbing

Unit 1	Plumbing Materials	Duty(s):
Unit 2	Plumbing Tools	Duty(s): UU
Unit 3	Plumbing Layout	Duty(s): SS,TT
Unit 4	Plumbing Basic Skills	Duty(s): VV,WW,XX,YY, ZZ,AAA
Unit 5	VICA Student Organization	Duty(s): A,B